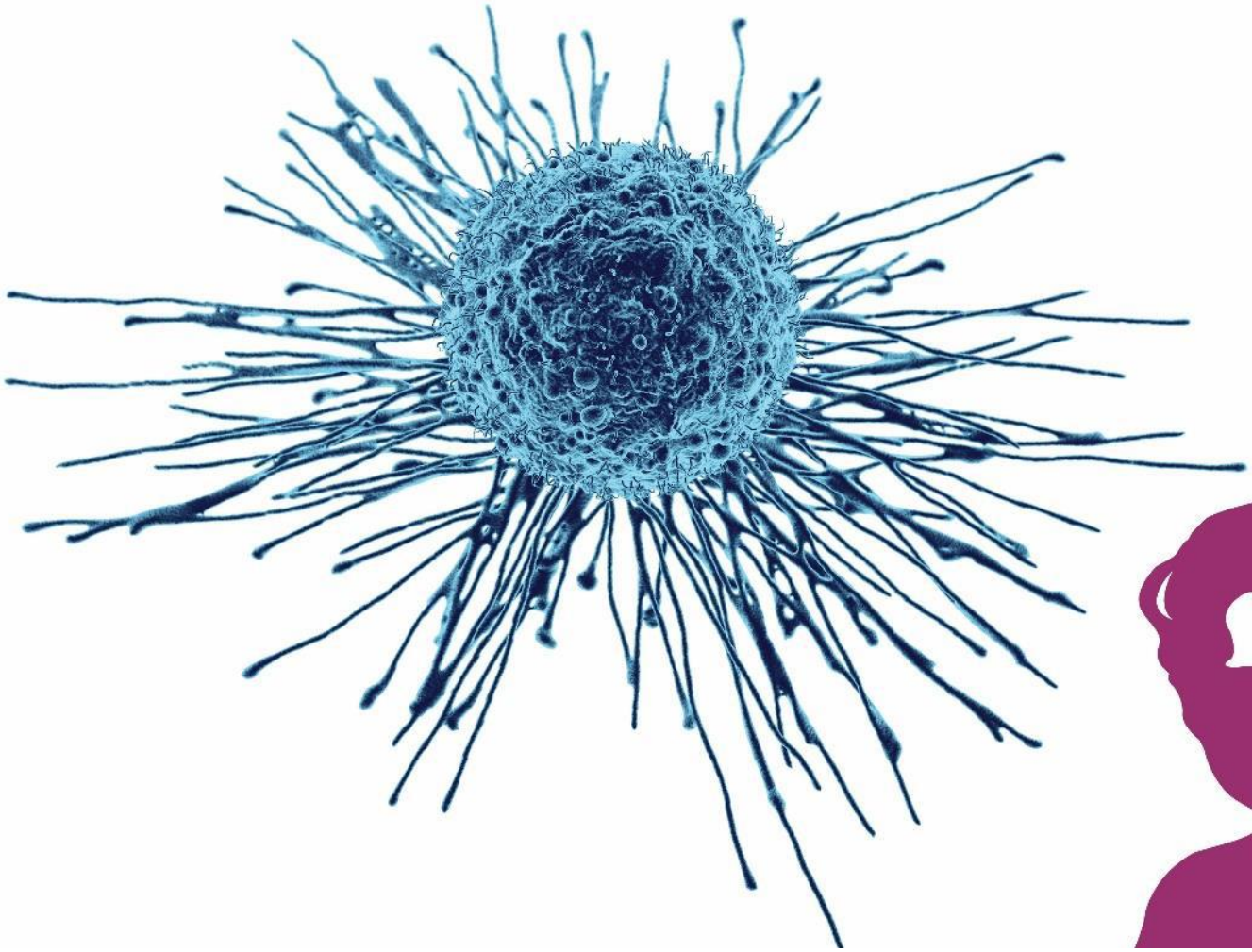


# MSCA Cluster Event on Cancer Research and Innovation

## Meeting Report and Key Messages for Policy Consideration

European Research Executive Agency, Brussels

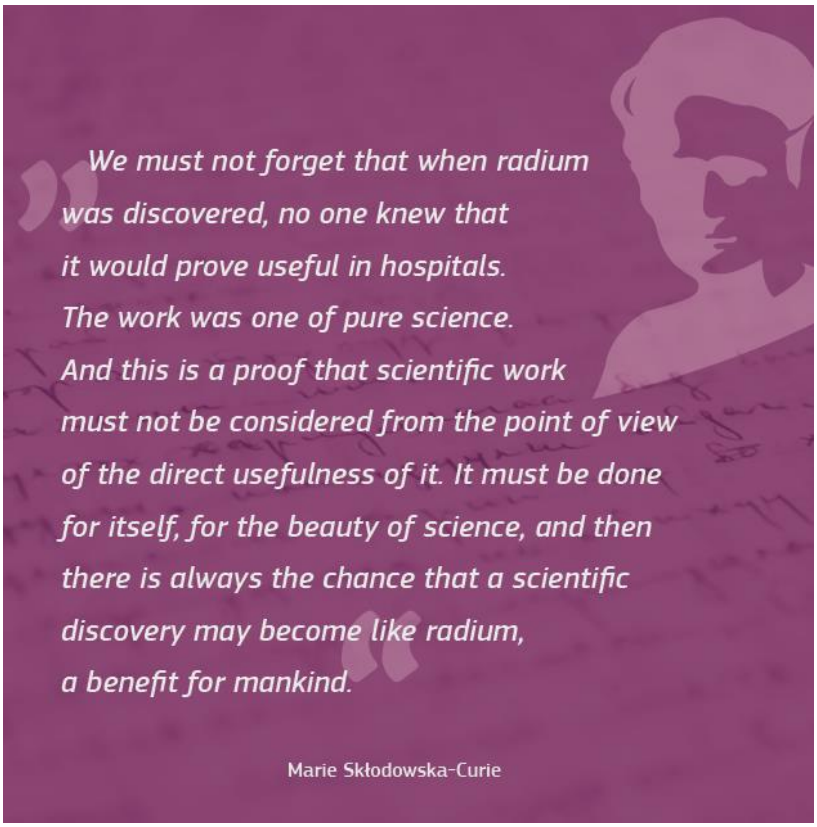
**18-19 March 2021**

EUROPEAN RESEARCH EXECUTIVE AGENCY

Excellent Science Department

Contact: REA-INFO@ec.europa.eu

European Commission B-1049 Brussels




*Marie Sklodowska-Curie was born on 7 November, 1867 in Warsaw, Poland, and passed away July 4, 1934, of anaplastic anemia by an occupational related illness caused by the handling of the very materials of her discoveries in radioactivity. Indeed, medicine may not be what it is today in terms of diagnosis and treatment of disease if it was not due to her dedication to her work. For example, together with her husband Pierre Curie, they discovered radium and applied it in World War I to make portable x-ray machines to diagnose patients with broken bones or with bullet or shrapnel wounds. Furthermore, they developed the idea to implant small bits of radioactive materials in tumors of cancer patients in order to shrink/kill tumors. She and her husband will be remembered for these great discoveries and the MSCA would like to honour their contributions through this report publication and continued funding of excellent science through the MSCA programme. Thanks to the dedication of researchers across Europe, and the globe, we wish for the legacy of Marie Sklodowska-Curie to live on to beat cancer. The selected quote underlines her attitude to science as one of strong will, perserverence and confidence. It also shows that exploratory research is crucial and therefore the role of "bottom-up" programmes like the MSCA. Science for the sake of discovery and discovery in the hope to have a positive benefit for humanity.*

# Table of Contents

# ACKNOWLEDGMENTS

This report is based on the work of the two experts invited to take part in the event and appointed to draft the meeting report: Dr Dimitris L. KONTOYIANNIS, Associate Professor of Cell Biology at the School of Biology of the Aristotle University of Thessaloniki, Greece; and Dr Marusela OLIVERAS SALVA, Intellectual Property and Innovation Expert.

The experts' contribution is mainly presented in Chapters 2 and 3 of the report. The introduction and conclusions (Chapters 1 and 4) have been drafted by the editorial team of the Research Executive Agency (REA) Marie Skłodowska-Curie Actions operational units who were also in charge of the organisation of the event: Daniela CECCARELLI (REA.A2), Alina SUHETZKI (REA.A2), Marianne DA SILVA (REA.A2), Tereza MAAROVA (REA.A2), and Amanda Jane OZIN-HOFSAESS (REA.A3), under the supervision of Maria SPULBER (REA.A2) and Jean-Bernard VEYRET (REA.A2).

The MSCA Cluster Event on Cancer Research and Innovation was jointly organised by the REA, in close cooperation with the Directorate-General for Education, Youth, Sport and Culture (EAC). In the core organising team, we would like to acknowledge the work of the following colleagues: Patricia RISCHITOR (REA.A1); Laurence MARRAMA-RAKOTOARIVONY (REA.A1); Elisabeta NEVE (REA.A2); Thierry JACQUIN (REA.A3); Frederico MIRANDA (REA.A3); Sandra PINTO MARQUES (REA.A4), Andrea HUTTERER (REA.A4); Marie DE LOOZ-CORSWAREM (REA.A4); Lara PASSANTE (REA.C1); Sandra RAMOS (REA.C1); and Julie LEPRETRE (EAC.C2)[1].



***Disclaimer***

*Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use that might be made of this document. The contents presented in chapters two and three of this document are the sole responsibility of the experts appointed for this event. Although REA staff facilitated the preparation of this document, the views expressed herein reflect the opinion of the experts and may not in any circumstances be regarded as reflecting an official position of the European Commission.*

[1] Affiliations reflect the situation at the time of the event organization

# ACRONYMS

- **COFUND** Co-funding of Regional, National and International Programmes
- **DG EAC** Directorate General for Education, Youth, Sport and Culture
- **DG ENER** Directorate General for Energy
- **DG RTD** Directorate General for Research and Innovation
- **EIT Health** European Institute of Innovation and Technology Health
- **ERASMUS+** EU's programme to support education, training, youth and sport in Europe
- **EU** European Union
- **EC** European Commission
- **H2020** Horizon 2020 Programme (2014-2020)
- **HE** Horizon Europe Programme (2021-2027)
- **IF** Individual Fellowships
- **IMI** Innovative Medicine Initiative
- **ITN** Innovative Training Networks
- **IP** Intellectual Property
- **JRC** Joint Research Centre
- **MSCA** Marie Skłodowska-Curie Actions
- **REA** European Research Executive Agency
- **RISE** Research and Innovation Staff Exchange
- **SME** Small and medium enterprises

# FOREWORD

Cancer is one of the main priorities of the European Commission (EC) in the health domain and it is a Mission under the Horizon Europe Framework Programme for Research and Innovation (2021-2027). The aim of Europe's Beating Cancer Plan is to tackle the entire disease pathway. It is structured around four key action areas where the EU can add the most value: (1) prevention; (2) early detection; (3) diagnosis and treatment; and (4) quality of life of cancer patients and survivors. Over the coming years, the strategy will focus on research and innovation, tap into the potential that digitalisation and new technologies offer, and mobilise financial instruments to support Member States.

Part of Horizon 2020 and Horizon Europe Excellent Science pillar, the Marie Skłodowska-Curie Actions (MSCA) support researchers from all over the world, in all scientific domains and at any stage of their careers. The world-class talented researchers and their cancer research took the central stage at a digital event jointly organised by the MSCA units of the European Research Executive Agency (REA) and the Directorate General for Education, Youth, Sport, and Culture (DG EAC) on 18 and 19 March 2021.

Based on policy relevance, the MSCA Cancer Cluster Event addressed five main themes: 1) diagnostics support to clinicians; 2) immunotherapy and antibody technology; 3) drug development; 4) prevention and personalized medicine; and 5) quality of life of patients and survivors. Over two days, the invited researchers presented the contribution of their respective research projects and engaged in fruitful exchanges with Policy Officers on the development of the state-of-the-art in cancer research and innovation. The event included other relevant projects in the fight against cancer such as those funded in the field of sport under Erasmus+ and by the European Institute of Innovation and Technology. The event demonstrated the high potential of the Marie Skłodowska-Curie researchers to contribute actively to the development of current and future policies in the interdisciplinary field of cancer research and innovation (R&I).



This report is intended for the EC services interested in learning about the contribution of MSCA to the cancer field and to the active R&I community more broadly. By joining forces in organising this event, we are confident that the REA and the European Commission's policy representatives created further synergies, stronger capacity, and more shared value, thus improving policy uptake, as well as overall collaboration. We hope that this event will pave the way for other similar events addressing key policy topics of interest to those in Europe and beyond.

**Begoña ARANO**
Head of Department A, REA

**Claire MOREL**
Head of Unit, DG EAC, Unit C2 MSCA

# EXECUTIVE SUMMARY

Every year, 3.5 million people in the EU are diagnosed with cancer, and 1.3 million die from it. Although over 40% of cancer cases are preventable, without reversing current trends, cancer could become the leading cause of death in the EU. Therefore, cancer has been and remains a priority on the European Commission's agenda.

In this context, and in support of the joint policy making approach, the REA together with DG EAC organised a thematic meeting of projects from the Marie Skłodowska-Curie Actions portfolio contributing to the EU-funded research on cancer.

The objectives of this cluster event were multiple. First, to showcase the excellence of MSCA researchers and their contribution to the state of the art of research and innovation related to cancer. Second, to promote discussion and get a better understanding of current obstacles in fighting cancer. Third, to provide coordinated input to the relevant EU policy-making services. And finally, to enhance synergies among projects based on new scientific insights and stimulate networking opportunities, particularly between MSCA Fellows.

Under Horizon 2020, the MSCA programme alone has supported 11.422 projects across all R&I domains. Out of these, almost 600 projects are broadly related to the topic of cancer.



Selection of projects to feature at the MSCA Cancer Cluster Event from this broad portfolio was based on those projects that could best promote discussion on the main thematic priorities identified by the Europe's Beating Cancer Plan. Hence, through a detailed portfolio analysis the projects retained were grouped under these main topics: diagnostics support to clinicians, immunotherapy, drug development and therapy, prevention/personalized medicine and quality of life of patients and survivors. Overall, the MSCA Cancer Cluster Event gathered a total of 54 projects.

The invited researchers, policy makers and experts discussed the future trends in cancer research and innovation and the policies needed to ensure that:

(1) researchers are supported in pre-clinical consolidation of primary research output, to meet the standards of potential industrial partners and of the final clinical environment;

(2) collaboration between companies is supported, especially to alleviate restrictions for combinatorial therapies;

(3) a more robust engagement of citizens and patients in all stages of cancer research is achieved, to incentivise sharing of medical data, donation of personal biomedical samples and participation in research protocol design and clinical trials;

(4) healthcare personnel are properly trained in the collection, annotation, and curation of data from many different biological and medical modalities to support the generation of *e-infrastructures*;

(5) a unified strategy that aligns goals and responsibilities is put in place to ensure that patients across EU Member States can benefit from better cancer care and treatment.

The main findings of the meeting have been subjected to a needs assessment and grouped into seven main points (**Box 1**) intended to support policy development, to raise awareness and to use for future capacity building of researchers.

**Box 1 – Identified needs for policy support**

1. ***Intersectoral communication***
2. ***Improved access to good quality patient data***
3. ***Specialized training in biomedical research community***
4. ***Facilitated translation of research discovery to clinical practice***
5. ***Emphasis in innovation management***
6. ***Citizens engagement in healthcare cancer research***
7. ***Reduced EU-wide inequities in accessing high-cost therapies***

Thematic cluster meetings of "bottom-up" programmes like MSCA on cross-cutting topics (i.e. artificial intelligence, cancer, climate crisis, soil health and food, etc.) are a good means of bringing different stakeholders together to exchange ideas and to foster collaboration. Ensuring the continued flow of information post-cluster event between policy makers and reserachers and actively fostering synergies between the various EU initiatives is the key to effective evidence-based policy making (i.e. feedback of practice to policy and policy that works for practice).

# Chapter 1 – Background

## 1.1 Introduction

Cancer is one of the main priorities of the European Commission in the health domain. President von der Leyen´s political guidelines[2] refer to "*a European plan to fight cancer, to support Member States in improving cancer control and care*", to reduce the suffering caused by this disease. From this vision, two flagship initiatives, the **Europe's Beating Cancer Plan**[3] and the **Horizon Europe Cancer Mission**[4] were developed, both to meet Europe's needs and to be a leading global contributor to the the fight against cancer.

The *Europe's Beating Cancer Plan* is a corner stone of the European Health Union built upon a co-creation process with all relevant stakeholders (research community, health professionals, patients). In February 2021, the Plan was officially launched with promised implementation of a 4 billion EUR budget between 2021 and 2030 across four main pillars:

- **Prevention**: addressing key cancer risk factors through creation of a tobacco free generation, reduction of alcohol consumption, promotion of healthy diets, support for high coverage of human papillomavirus (HPV) vaccinations for boys and girls, engagement towards better air quality aligned with WHO guidelines, etc.

- **Early detection**: improving knowledge, access and quality of diagnostics in all Member States, through new cancer screening arrangements, quality assurance schemes, identifying individuals at high risk common cancers, etc.

- **Diagnosis and treatment**: ensuring the creation of network of national cancer centers within and among Member states, inter-specialty training programmes, mobilization of high-performance computing, etc.

- **Quality of life for patients, survivors and carers**: creating a Cancer Survivor Smart Card (providing an overview of the medical history of former cancer patients), fair access for cancer survivors to financial services, better work-life balance for carers.

Additional flagships initiatives include the **Knowledge Centre on Cancer** and the **European Cancer Imaging Initiative** to boost research and innovations reaching patients; the **Helping Children with Cancer Initiative** for rapid detection, treatment and care; and the **Cancer Inequalities Register** to improve equalities in healthcare across the EU.



[2] political-guidelines-next-commission_en_0.pdf (europa.eu)
[3] Europe's Beating Cancer Plan (europa.eu)
[4] Mission area: Cancer | European Commission (europa.eu)

Closely aligned to the Europe's Beating Cancer Plan, is inclusion of cancer topic (*Mission Cancer*[5]) as one of the five Horizon Europe Research and Innovation missions launched in September 2019.

The **HE Cancer Mission** provides 13 main recommendations for action[6]:

1. *Launch UNCAN.eu – a European Initiative to Understand Cancer*
2. *Develop an EU-wide research programme to identify (poly-)genic risk scores*
3. *Support the development and implementation of effective cancer prevention strategies and policies within Member States and the EU*
4. *Optimise existing screening programmes and develop novel approaches for screening and early detection*
5. *Advance and implement personalised medicine approaches for all cancer patients in Europe*
6. *Develop an EU-wide research programme on early diagnostic and minimally invasive treatment technologies*
7. *Develop an EU-wide research programme and policy support to improve the quality of life of cancer patients and survivors, family members and carers, and all persons with an increased risk of cancer*
8. *Create a European Cancer Patient Digital Centre where 25 cancer patients and survivors can deposit and share their data for personalised care*
9. *Achieve Cancer Health Equity in the EU across the continuum of the disease*
10. *Set up a network of Comprehensive Cancer Infrastructures within and across all EU Member States to increase quality of research and care*
11. *Childhood cancers and cancers in adolescents and young adults: cure more and cure better*
12. *Accelerate innovation and implementation of new technologies and create Oncology-focused Living Labs to conquer cancer*
13. *Transform cancer culture, communication and capacity building.*



The mission-oriented R&I approach allows success and solutions by involving citizens and stakeholders more closely in setting research priorities and allowing equal access to everyone. This approach will give a clear direction with strong deliverable deadlines, will drive multiple, bottom-up solutions, and will move fast thanks to the launch of multiple initiatives at the same time.

Given this strategic context, the timing was right for the organization of the MSCA Cancer Cluster Event, one bringing practitioners and researchers together with policy makers to discuss trends in research and key challenges in the field. This report provides a comprehensive summary of the keynote presentations, project presentations, panel discussions, e-poster and networking sessions of the event. The reader will come away with a better understanding of the contribution of MSCA projects to cancer R&I, recent advancements and overview of priorities challenges and areas for policy consideration.

[5] Mission area: Cancer | European Commission (europa.eu)

[6] ec_rtd_mission-board-report-cancer.pdf (europa.eu)

## 1.2 MSCA and cancer research and innovation

Under Horizon 2020 (2014-2020), the MSCA programme has provided 6.2 billion euro to support 65.000 researchers and more than 1000 doctoral programmes across Europe and beyond. The programme is about achieving excellence in science – as part of the Horizon 2020 strategic pillar ***Excellent Science*** – whilst achieving excellence in research careers. Both elements are important in fostering a vibrant European Research Area.

More specifically, the MSCA provide grants for all stages of researchers' careers and support the development of knowledge and enhancement of skills through ***mobility***, in the sense of **crossing borders** within and outside Europe, **crossing sectors** by performing research and training in both academic and non-academic organisations; and **crossing disciplines** by doing research that requires collaboration between different scientific fields. The MSCA enable research-focused organisations to host talented scientists and provide them with innovative research training and networking opportunities. Through this mobility and knowledge sharing it supports the creation of long lasting global partnerships with a wide range of institutions.

The actions are open to all domains of R&I, from fundamental research to market take-up and innovation services, with a participation of industry as well as SMEs. Scientific fields are chosen freely by the applicants in a fully bottom-up approach. Moreover, through the high-quality work of the funded researchers and their multidisciplinary approach, the MSCA sheds light on the latest trends in innovative research (summary of MSCA main characteristics - **Figure 1**).



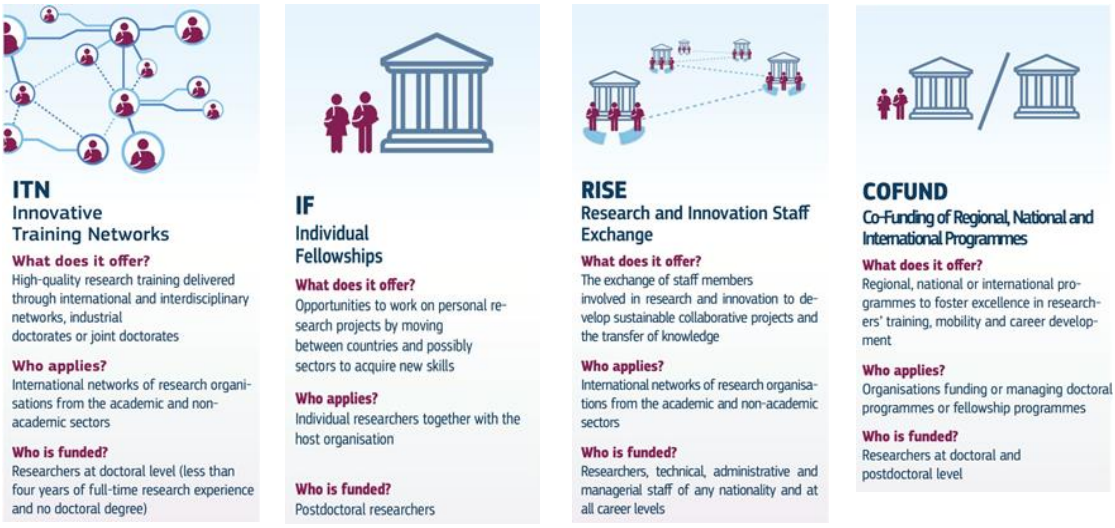



***Figure 1**: Overview of MSC actions*

In addition to the four actions listed in **Figure 1**, the European Researchers' Night (NIGHT) supports EU-wide public events aimed at bringing researchers closer to the public and stimulating interest in research careers, especially among young people.

For the MSCA Cancer Cluster Event more than 9.500 projects across all R&I domains – representing advanced and completed projects from the MSCA calls 2014-2019 – were considered (further details in section 1.3 of this chapter).

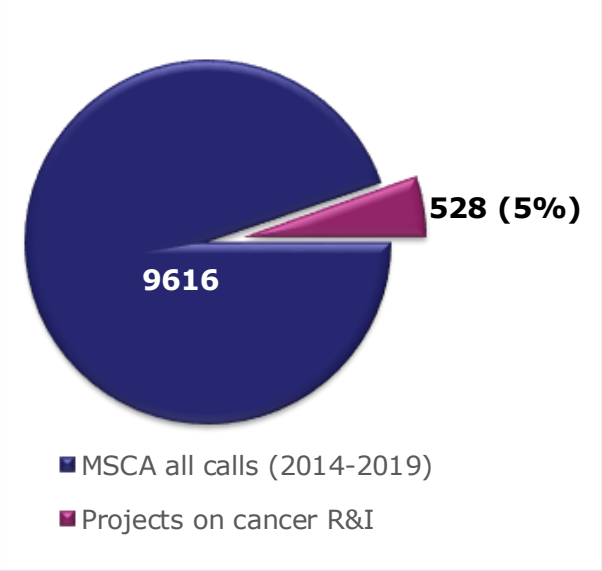



***Figure 2**: MSCA cancer projects.*

The analysis showed that 528 projects were dealing with cancer research and innovation (**Figure 2**). The overall EU budget invested in MSCA projects exploring cancer research and innovation is of EUR 414 million (**Table 1**). This goes up to EUR 481 million if including some of the 2020 MSCA calls that have been finalized at the time of drafting this report (**Annex A**).

As a bottom-up programme, one of the strengths of the MSCA is that it enables researchers to contribute to joint policy-making through their high-quality results and fresh ideas.

***Table 1:** MSCA funding to cancer R&I, breakdown per actions, number of researchers financed (calls 2014-2019).*

| Action | Projects | Researchers | Total Budget (EUR) |
|---|---|---|---|
| COFUND | 9 | 231 | 20.385.480 |
| IF | 408 | 408 | 75.888.948 |
| ITN | 88 | 1175 | 294.345.542 |
| RISE | 23 | 1045 | 23.481.100 |
| **Total** | **528** | **2859** | **414.101.071** |



## 1.3 Event concept

### Scope

REA manages a large portfolio of H2020 projects and provides programme and policy feedback to the relevant DGs of European Commission for their consideration. REA's four MSCA units joined forces with DG EAC to organise a joint cluster event on cancer research and innovation involving all four REA MSCA units. Together the organizing team arranged a stimulating scientific programme and panel discussions on policy areas that affect all of our lives; i.e. policy "needs" (**Box 1**, pg 10) directly relevant to cancer (prevention, diagnostics, treatment and quality of life priorities) and policy needs more widely applicable to health care sector and digital era in health.

The event aimed to:

- showcase the excellence of MSCA researchers and their contribution to the state of the art of research and innovation related to cancer
- promote discussion and get a better understanding of current obstacles in fighting cancer
- providinge coordinated input to the relevant EU policy-making services
- enhance synergies among projects based on new scientific insights and stimulate networking opportunities, with an emphasis among MSCA Fellows.

## Methodology for selection of MSCA cancer projects

Cancer is a highly represented subject across all scientific disciplines in all MSCA actions (**Annex A**).

Considering such an extensive portfolio, a **step-by-step approach** for the preliminary analysis of the portfolio across MSCA actions was applied, using the keywords originally agreed upon for the Horizon Europe Mission Area for Cancer (*Cancer, Tumor/Tumour, Malign** and *Oncog*/Oncol*)*.

MSCA Project Officers carefully screened this first selection and removed all projects not specifically dealing with cancer. The final portfolio of projects working on cancer across all MSCA actions amounted to 528 projects. At the time of the organization of the cluster event, only projects from 2014-2019 MSCA calls were included as several 2020 calls were ongoing or not started yet.



Within this portfolio, a second set of keywords (*Diagnos*, Therap*, Clinic*, Policy/Policies, Patient, Innovation*) were used to identify the main topics each project contributes to. The analysis of the projects' abstracts helped to refine the topic classification.

Across the whole MSCA programme, the majority of projects focus on different aspects of therapeutic and diagnostics innovation and investigate a wide spectrum of cancer types. Some specificities were observed for each action, as follows:

- **MSCA-IF**: mostly fundamental research (i.e. biological pathways, immune response)
- **MSCA-ITN**: antibody technology, gene therapy, epigenetics, and metabolism/metabolic markers
- **MSCA-RISE:** tumour imaging/diagnosis innovation
- **MSCA-COFUND:** fundamental research, some translational and clinical research projects.

Based on the preliminary portfolio analysis and policy/scientific relevance, it was decided to address the following themes:

- Diagnostics support to clinicians (surgery imaging, computed models)
- Immunotherapy / antibody technology
- Drug development (including nanomaterials, artificial intelligence and cutting edge topics)
- Prevention / Personalized medicine
- Quality of life of patients and survivors

Each of the four MSCA units involved in the organisation of the event undertook a qualitative assessment of the cancer projects to select the most successful projects within the chosen scientific theme. The Project Officers were key players in this process. As a result, 18 projects were invited as speakers to the event, both ongoing and completed projects, and 31 projects prepared e-posters for a virtual poster session, mirroring the five main thematic panels relevant for both scientific and policy aspects of cancer R&I.

Furthermore, projects from the programme ERASMUS+ and from EITHealth, both managed by DG EAC, were invited to contribute to the cluster event as both speakers and e-posters. Altogether, the cluster event gathered a total of 54 projects.



**Meeting format and content**

Taking into account the COVID-19 pandemic and the constraints it generated, it was agreed that the event should be run in a fully online format using an external contractor. They created a website with all relevant background materials and links for the two-day live broadcasted event. The full programme of the event is available in **Annex F**. Recordings of the event are available at MSCA Cluster Event on Cancer Research and Innovation (europa.eu).

In terms of best format, non-parallel plenary sessions were selected, as they offered the audience the possibility to join any or all the thematic panels in different areas of cancer R&I and interact with the speakers via live Q&A in a designated tool (www.slido.com; details in **Annex D**).

Content-wise, the selected policy areas were organised in five scientific panels each including four project talks: 1) **Diagnostics support to clinicians**, 2) **Immunotherapy**, 3) **Drug development and therapy**, 4) **Prevention and Personalized medicine**, and 5) **Quality of life of patients and survivors**. NOTE: for panels 4 and 5, one project from ERASMUS+ and one project from EITHealth were included, respectively for complementary view of the themes. The panels were moderated by Policy Officers from different EC Directorate Generals and were introduced by management of the REA MSCA units.

Throughout the programme synergies with other cancer-related programmes were highlighted through presentations led by key EC representatives. These included the Europe's Beating Cancer Plan and the Horizon Europe Cancer Mission (opening session). The SAMIRA Action Plan (Panel 1), the ERA-NET TRANSCAN (Panel 3), the International Consortium for Personalised Medicine – IC PerMed

(Panel 4) and the ECIS - European Cancer Information System (Panel 5). Moreover, a panel discussion was dedicated to a policy round table and funding opportunites discussion. Here, the colleagues from the Commission (DG SANTE, DG RTD, DG EAC) and from public-private partnerships (Innovative Medicine Initiative and EITHealth) guided the audience through the multiprogramme approach for the EU fight against cancer with clear linkage and synergies with the Europe's Beating Cancer Plan and the HE Cancer Mission.

Alongside the 20 projects contributing to the scientific panels, another 34 projects were also invited to present their work via e-posters, i.e. short (3-4 minutes) pre-recorded video presentations. A dedicated session for e-posters was available throughout the duration of the event, and e-posters could be visited either via a 3D virtual environment on the event website or directly on the platform Vimeo, to increase visibility (**Annex J**). A system to book one on one virtual meetings was set up to encourage the interaction between e-poster presenters and participants. To ensure audience engagement, a voting system was set up to pick an e-poster winner which was later announced during the closing session (**Annex C**).

An EU-survey was organized to receive feedback from the audience after the event. Detailed results are shown in **Annex E**.

To further wrap-up the event, the two appointed scientific and Innovation Radar experts provided a foresight view of the entire event during the closing session. Following the meeting, the experts supported the drafting of this report providing the take-away messages for policy considerations (**Box 1**, pg 10) as well as further recommendations (**Chapter 2**), and a robust summary of the presentations and panel discussions (**Chapter 3**).

# Chapter 2 – Policy Considerations

The MSCA Cancer Cluster Experts summarised the key messages identified as "needs" for policy consideration. Albeit coming from discussions where MSCA projects presented their results, it is important to note that the needs and future challenges identified are not MSCA specific, but address cancer research at large.

## 2.1 Identified needs

**1. Need for intersectoral communication.** Research in Cancer integrates many different disciplines: from clinical medicine, biology, and chemistry to engineering, information systems, and material sciences. The outcome of this integration is excellence in knowledge and outstanding innovations for prevention, diagnosis, clinical management, and personalised treatments. Still, many innovations do not reach the patients due to communication barriers between academic, industrial, and healthcare sectors. This lack in communication can be attributed to differences in (a) capacities, (b) end-goal settings, (c) impact metrics, (d) scientific, managerial, and exploitation practices, and (e) a lack of a "common language".

**2. Need for accessing good quality patient data.** The future development of personalised cancer treatments is based primarily on the appropriate exchange of multivariant clinical, genetic, molecular, healthcare, and lifestyle data on a per-patient basis. These are needed for the discovery, benchmarking, and quality control of research outputs; in addition to the adequate investment on and design of primary care and aftercare. The generation of e-infrastructures for storing such data and the creation of biobanks for storing human material is well underway at the EU and regional levels, and their support should continue for the patients' benefit. However, healthcare providers need to employ global standards for collecting, storing, curating and sharing data in a suitable way to meet their needs, thus maximising the translatability and statistical validity of research outputs across different territories. Such standards can be provided by dedicated e-infrastructure programmes for other biological and medical data (e.g. EOSC-Life).



**3. Need for training.** Academic researchers should be trained in industry-related procedures and standards of practice, in topics such as utility-driven R&D, technology transfer, entrepreneurship, and regulatory requirements, as well as issues relating to policy-making. Such training is crucial for alleviating communication barriers between academia and industry stakeholders or policy-makers. Besides academic researchers, healthcare professionals should be trained in using and understanding the new possibilities provided by emerging diagnostics, therapeutics, medical devices, and rehabilitation approaches. One may anticipate that, as Cancer research advances rapidly, a new generation of professionals will follow to consolidate healthcare innovations. Finally, citizens and patients should learn more about modern preventive measures, clinical trials, and rehabilitation platforms, and in the end use them for their benefit.

**4. Need for facilitating the transition from research to practice.** Undoubtedly, high-quality academic and translational research is conducted in many EU-funded projects, which has yielded significant innovations in diagnosis, therapy, medical devices, and aftercare. However, several of these innovations do

not reach the patient. The main reason is the gap in transitional pre-clinical research to consolidate the proof-of-concept in order to meet industrial and/or clinical standards that will allow for their further development. This pre-clinical research is essential to facilitate the transfer of innovations towards the industry and, ultimately, reach the patient.

**5. Need for innovation management.** The innovation aspects associated with (personalised) cancer research are somewhat different from the traditional ones, mainly due to the multiomic and algorithmic approaches using (and reusing) individual patient data or collections of clinical information such as databases, both aspects highly interlinked to information governance and influencing decision-making. Another challenge that emerges from cancer research on combinatorial treatments based on repositioning existing therapeutic drugs (*repurposing*) belonging to different companies, is each company's contained willingness to openly collaborate with a potential competitor towards a common goal that will ultimately benefit the patient. Helping removing hurdles which prevent companies from collaborating should be fostered by the EC.

**6. Need for involving citizens in healthcare cancer research.** The success of the Europe's Beating Cancer Plan and the HE Cancer Mission relies on the trans-regional development of individual- and patient-centric healthcare approaches. It is essential to gain the trust and promote patients' engagement and involvement in all stages of research and policy-making. Besides being the source of biological material essential to basic research, patients can play instrumental roles in providing their perspectives during the developmental and consolidation phases of translational research. The patients' capacity for involvement in research is practically unlimited, from participating in outreach activities for the general public to supporting funding schemes, mobilising local bodies, and engaging in research design and outcome impact.



**7. Need for addressing regional inequities in accessing high-cost therapies.** A caveat of sophisticated innovations to treat cancer (for example, nanosensor devices or immunotherapies) is their large investment in research and development, which impacts on their final acquisition price. Eventually, this may lead to noticeable inequities in healthcare provisions within a same region – for example, large hospitals vs small clinics, or cities vs countryside – and across EU Member States, each with different priorities, financial capacities, and insurance systems.

Following the MSCA Cancer Cluster Experts' analysis of the meeting's outcomes, the findings were organised into strengths, weaknesses, opportunities, and threats (SWOT) to comment on the trends in the cancer research areas and potential innovation, for policy consideration, as presented in **Table 2**.

***Table 2**. MSCA Cancer projects: SWOT analysis on the trends in cancer research and innovation*

| Strengths | Weaknesses | Opportunities | Threats |
|---|---|---|---|
| High interdisciplinarity | High R&D cost of sophisticated approaches | Intersectoral strategies for alignment of capabilities | Local and regionals inequity |
| Higher interface and integration | Limited translatability of research outputs due to patient data quality and access | Holistic approaches | Level of cooperation among companies |
| Higher innovative outcomes with large potential | Lack of intersectoral communication | Multilevel training | |
| Personalised approach for Cancer healthcare and treatment | Inadequate support via pre-clinical translational funding | Patients and citizens engagement and involvement | |

## 2.2 Future Directions



Cancer research has reached a high level of advancement in (basic) knowledge and innovative applications to prevent and combat this disease. Cancer researchers have provided a deep understanding of the many forms of this disease at the macro and molecular levels highlighting the complex dynamics and areas where further exploration is needed. More than this, the field is moving forward in taking bench discoveries to practice through a multitude of technologies for personalised monitoring and treatment of patients. From the cancer funding and policy side, it is noteworthy that the current and past EU research framework programmes for years are already engaged in and aligned with the four key actions of the Europe's Beating Cancer Plan. Therefore, there is great promise in the upcoming Horizon Europe framework programme to build on these legacy programmes and move forward on theidentified strengths and opportunities flagged in this report (**Table 2**). Since there are plenty of EU funding instruments supporting initiatives to foster networks and turn ideas into innovations within the cancer field, one risk is to loose the oversight and to make the best use of the outcomes. This need for good communication and synergies was listed as key weaknesses and threats in the cancer field (**Table 2**). This report also speaks to these areas as it is where policy can play a most significant role.

The MSCA Cancer Cluster Experts reported that the HE Cancer Mission requires a unified approach for intersectoral collaboration that aligns goals, gains, risks, and responsibilities, while ensuring that patients across the EU Member States can benefit from equal and better cancer care and treatment. This will also help finding common grounds in (i) understanding the heterogeneity of cancers; (ii) raising communication barriers between academic researchers, industrial partners, healthcare providers, and patients; (iii) facilitating the rapid translation

of research findings towards the healthcare application; and (iv) ensuring that projects deliver practical cost-effective approaches for the direct benefit of all patients. The success of such a strategy will depend upon the pivotal engagement of policy-makers in private/academic alliances and regional ecosystems in the healthcare sector.

The **pre-clinical consolidation of primary research outputs** is an issue that needs to be addressed urgently. Academic scientists face difficulties in raising investment for the pre-clinical consolidation of their laboratory results to meet the standards of potential industrial partners and of the final clinical environment. Translational proof-of-concept research is essential. However, investors consider it high risk, particularly regarding expensive endeavours in immunotherapy, nanomedicine, or multiomic-based personalised approaches. This gap needs to be seriously considered by policy-makers in order to strengthen funding schemes that would reduce the risk of pre-clinical testing, facilitate academic and large or small corporate partnerships, and that would not be restricted by the traditional academic impact metrics (e.g., publications). Policy-makers should also consider that personalised medical innovations require significant investments – both at the developing and implementation ends. This is a severe threat that may slow down innovation potential as well as lead to regional inequities. This risk needs to be dealt with by identifying ways to make these innovations more cost-effective and accessible to all patients.

Means to motivate the **collaboration between companies** should also be provided – especially for combinatorial therapies. Academic research provides the essential foreground for new specific therapeutic strategies by combining already existing pharmaceuticals owned by different companies. Alleviating restrictions for the combinatorial usage of these drugs would provide an opportunity and holds great promise towards cost-effective therapeutic regimes.



The need for **developing personalised approaches** requires the open flow of patient-centric data. The generation of e-infrastructures for collecting/archiving such data and the creation of biobanks for storing human material is well underway at the EU and regional levels, and their support should continue for the patients' benefit. However, healthcare providers have limited EU/global standards for collecting, storing, and curating data in a suitable way to meet their needs, thus limiting the translatability and statistical validity of research outputs across different regions. Healthcare organisations should be encouraged to form teams of personnel trained in the proper collection, annotation, and curation of data from many different biological and medical modalities (imaging, hematologic, genetic, genomic, etc.). In parallel, the EU and its Member States should provide directives to guide healthcare providers on managing such departments internally, advising them on data handling issues and connectivity of records to help researchers while protecting the patients' ethical and legal rights.

Linked to data collection and material biobanking, the MSCA Cancer Cluster Experts consider a need to strive for a **more robust engagement of citizens and patients** in all levels of cancer research to facilitate these goals. Citizens should be informed on the usefulness of sharing their medical data (within the adequate governance framework), the advantage of donating their material to biobanks, and the benefits of engaging in research protocol design and clinical trials participation. A greater openness towards the patients is the way forward to embrace novelty, avoid scepticism, and promote changes at EU regional level. Patient associations' and charities' attention towards cancer research, information

and developing public awareness and scientific literacy should be strengthened across all EU Member States to support the HE Cancer Mission and the Europe Beating Cancer Plan.

Only by aligning cancer research to the patients' interests at national, regional, and local levels will Europe nurture innovation, promote industrial engagement, attract highly skilled talent, and support the HE Cancer Mission. Moreover, the interdisciplinarity required to target cancers will require new researchers and healthcare professionals and hence promote the creation of more jobs. By providing high-quality training to academic researchers, the MSCA currently invests in skilling the European workforce, which helps avoid a brain drain both outside Europe and within it from more impoverished regions to wealthier ones, and offers career development and professional opportunities.

# Chapter 3 – Cancer Research in MSCA

The MSCA Cancer Cluster Experts provided a summary of the critical elements of the presentations to understand the state-of-the-art in the pillars of the HE Cancer Mission. They captured the core points addressed in the panel discussions and provided their opinion on the innovation potential in the field and areas where policy-making is needed to meet the needs of the scientific developments.

## 3.1. MSCA projects in Diagnostic Support to Clinicians

Biomarkers can discriminate cancer traits or signs of metastasis at different stages of the disease; they are essential for diagnosis, disease monitoring, and personalised treatment design. Although research in diagnostics gains less attention than research in therapeutics, several **projects funded by MSCA supported the development of (a) imaging biomarkers** i.e. distinct biological features present in images generated via radiological or other labelling techniques; **(b) cellular biomarkers** i.e. circulating tumor subsets detected via cytometric or spectroscopic techniques; and **(c) molecular biomarkers** i.e sugars, proteins and nucleic acids detected via ligands coupled to specific matrices or biosensors.

A characteristic of tumor cells is the altered consistency in sugar structures (glycans) and glycoproteins on their surface. These molecular alterations can be used to detect tumor cells in the body. To that end, the **"Imaging and detection of tumor-associated glycan structures on tumor cells" (GlycoImaging, MSCA-ITN)** project focused on charged sialic acid (SA) containing glycans attached to many surface glycoproteins. As reported by the project researcher, tumor cells have more extended glycan structures, and their shortening reduces tumor growth. Researchers engineered silica-based molecular polymers imprinted to bind long SA sugars on tumor cells whereas they are cleared by immune cells if unbound. This approach holds promise for the early detection of cancer cells, even those circulating in the blood, using digital imaging techniques. Moreover, it may provide a safe, cost-effective alternative to the use of expensive reagents like antibodies against proteins or lectins against complex sugar structures.



On a similar subject, the **"Matrix glycans as multifunctional pathogenesis factors and therapeutic targets in cancer" (GLYCANC, MSCA-RISE)** project explored changes in proteoglycans (PGs). Physiologically, these large glycoproteins are part of the extracellular matrix forming the scaffold of tissues. The project identified specific PGs marking cancer stem cells in inflammatory *breast cancers*. It also provided two, label-free, analytical platforms for the clinical diagnosis of such PGs. The first - Fourier Transformed Infrared (FITR) Spectroscopy - can be used in a pathology laboratory to reveal broad differences in proteoglycans. The second - Atomic Force microscopy - provides holistic and quantitative imaging of proteoglycan structures. The project demonstrated the analytical power of these approaches *in breast cancer and gliomas.* The challenge for translating these analytical platforms to the clinic is the generation of the appropriate clinical instruments; still, such an industrial investment could be

worthwhile towards efficient and cost-effective diagnostics that do not require additional reagents.

The metanalysis of existing imaging data can provide novel strategies for diagnosis and disease monitoring. The project entitled **"Patient-specific tumor growth model for quantification of mechanical 'markers' in malignant gliomas: Implications for treatment outcomes" (GlimS, MSCA-IF)** used computational methods to analyse the growth of brain tumors (*glioblastomas)* using MRI (Magnetic Resonance Imaging) scans. It quantified the infiltrating and biomechanical forces exerted by the tumor to brain tissue. Using those features as biomarkers, the researchers developed models in the project to correlate tumor growth phenotypes to tumor progression and prognosis. Overall, the project outcomes revealed a new kind of patient-specific imaging biomarkers which can supplement molecular biomarkers for personalised treatment. The challenges for computer-aided techniques include the need for extensive, curated, and high-quality clinical imaging datasets; the extensive benchmarking of algorithmic models; and the strong collaboration between informatics communities to develop robust and reliable tools.

Several oral and poster presentations reported findings on specialised nanoparticles for tumor detection and drug delivery (also see Section 3.2). Such is the **"Development of novel approaches using trimagnetic nanoparticles for intracellular hyperthermia of prostate cancer cells" (iCARE-2, MSCA-COFUND)** project. It culminated in the generation of magnetic nanoparticles (MNPs) that have (a) very high absorption rates and give high contrast images in MRI when coated via e.g. sugars for absorption by tumors; (b) have minimal generic toxicity as opposed to radiation therapy but kill tumors following exposure to alternating magnetic fields that force the nanoparticles to emit high temperatures. Proof of principle was provided in pre-clinical models of *prostate cancer*. Further developments in clinical instrumentation are needed to support the transition of this platform in the clinic.



During the **poster presentation**, researchers also reported on advances in microdevices and biosensors to be used for lab-based diagnostics. For MSCA-RISE project **MAGNAMED** approaches using nanodisks possessing modified magnetic properties that can be coupled to magnetoresistance sensors were explained. These nanodisks can be coated with analytical tools for biomarker detection through medical biosensor devices in a clinical lab. Similarly, MSCA-RISE project **CanBioSe,** describes approaches for the generation of metal-oxide nanofibers coupled to portable biosensors for cancer markers.

On the application side, there were the following project developments in: MSCA-ITN **AiPBAND** applied specialised biosensor devices for markers of brain tumors; in MSCA-IF **pure CTC** chip-based fluidic system were implemented to detect rare circulating tumor cells from peripheral blood based on their electrical impedance; MSCA-RISE **miRNA-DisEAsy** used sensitive biophotonic sensor for detecting miRNAs in *lung cancer*; and MSCA-ITN **UbiCODE** developed molecular traps capable of recognising ubiquitinated proteins destined for degradation or means to send pathogenic proteins for ubiquitin-induced degradation.

Other e-posters explained the exciting developments for the identification of novel molecular biomarkers e.g. for prostate cancer (EITHealth **STOCKHOLM3**) or on bioinformatics tools collecting variant data (patient, xenografts, drug effect

etc) to identify genomic alterations in *breast cancer* for more precise personalised treatments (MSCA-IF **BRIDGES**).

### Critical challenges in diagnostics

During the panel discussion, the speakers had the opportunity to interact with the audience via questions taken via SliDo (www.slido.com) and further reflect on their projects and the challenges currently experienced using various approaches.

**#1 Under appreciation of diagnostics research.** Undoubtedly, high-quality research is conducted in many projects that can provide novel biomarkers, analytical procedures, and new reagents for diagnosis and monitoring. However, those aiming for direct translation towards the clinic are significantly less, indicating a gap in the processes required for developing cost-effective and clinically relevant diagnostics. In this respect, future EC calls should also strengthen the training of basic researchers on the importance and procedures needed in the industrial development and diagnostic products and equipment; and healthcare providers in diagnostic innovations.

**#2 Connecting with industry.** Unlike other research efforts, research on diagnostics needs to be measured on its impact on many different industrial sectors - even beyond biomedicine and engineering, energy, and material sciences. Only through such interactions can efforts yield final products, instruments, and services to clinicians. However, fundamental researchers in diagnostics are still bound to academic rules where research publications primarily measure impact. As presented by the participants in this panel, entrepreneurial efforts are being made by academic researchers to approach industry representatives and ventures - but these are rather stochastic. Researchers often do not have the skill set necessary to develop a product or write a business plan. Efforts should be made to enhance the researchers' skills to communicate effectively their research to industry representatives and investors, and to handle intellectual property rights (IP) and confidential information. Moreover, more centralised international schemes should be considered for events that bring academic researchers and investors together and overcome inequities in accessing such events at regional or institutional levels.



**#3 Access to good quality clinical data**. In many instances, healthcare organisations cannot fulfill the data needs of research projects or provide appropriate data. Healthcare organisations should be encouraged to form teams of personnel trained in the adequate collection, annotation, and curation of data from many different modalities (imaging, hematologic, genetic, genomic, etc.). In parallel, the EU and its Member States should provide directives that support healthcare providers and guide hospitals and other relevant organisations on how to manage such departments internally, advising them on data handling issues and connectivity of records to help researchers while protecting the patients' ethical and legal rights.

## 3.2. MSCA projects in Drug Development and Therapy

Traditional approaches for treating cancer are to be replaced by more precise and personalised ones with minimal side effects. The success of transforming new drugs into clinical therapeutics requires cross-sectorial integration and links to the pharmaceutical industry. To that end, the panel benefited from the participation of an industry representative from the MERCK group. The selected **MSCA**

**projects reflected these challenges by presenting on (i) effective treatments for rare cancers**, **(ii)** technological developments to **intervene therapeutically into dynamic tumor niches**, and **(iii) combination therapies**.

More than two hundred different rare cancers have been identified to date. The small number of patient cohorts suffering from such cancer requires cross-sectorial "bed-side to bench-side" approaches in understanding and treating them at a personalised level. The **"Drug Discovery and Delivery NEtwork for ONcology and Eye Therapeutics" (3D NEONET, MSCA-RISE)** project used such an approach for *uveal melanoma*. This rare cancer of the eyes differs from the skin's melanoma and has very aggressive metastatic potential with fatal consequences. Researchers isolated patient tumor cells and transplanted them into the eyes of special immunodeficient mice or zebrafish as xenografts (patient-derived xenograft (PDX) models). In doing so, they essentially transformed a human patient cohort to a PDX-animal cohort while maintaining the genetic variability of each tumor. The approach provides two main benefits: (a) it can discriminate individualistic patient traits versus traits conserved across patient xenografts, and (b) delivers a platform for the pre-clinical development of diagnostic and therapeutic approaches at personalised and population levels that cannot be developed via clinical trials in such small cohorts. The project provided a proof-of-principle case where it identified a leukotriene receptor as a marker of poor patient survival across tumors. It used an already available leukotriene receptor antagonist drug currently used to treat allergic inflammation. The outcome was beneficial against the proliferation and metastasis of uveal melanoma tumors, allowing for the repositioning of such drug to treat patients with this rare type of cancer and other types of cancer like *oesophageal* and *colon cancers*.



As tumors progress, they acquire individual genetic mutations due to genomic instability. Most of those are tolerable and compatible with tumor-cell survival. Such a trait provides a therapeutic opportunity, since one can engineer a second - genetic or functional - mutation intolerable only by tumor cells with the specific first mutation. Cell death induced via concurrent mutation of multiple genes is referred to as "synthetic lethality" and is a promising approach for modern therapies. Along these lines, the **"Targeting SYNthetic lethal interactions for new cancer treatments TRAINing network" (SYNTRAIN, MSCA-ITN)** project speaker presented genetic platforms aiming to identify genes interacting within tumor cells whose combinatorial inactivation can promote synthetic lethality. Furthermore, the project aim was to screen for chemical entities promoting synthetic lethal interactions affecting DNA replication stress, which is usually bypassed in *cancer cells*. The way forward for such approaches is to connect the heterogeneous genetic makeup of a given tumor to gene-interacting network; this can be exploited for the synthetic lethality screens of chemical entities or genome editing tools.

The rationale of a "two-hit" approach can also be envisaged when tumors become resistant to single-drug therapies by acquiring additional passenger mutations. A structure-based mathematical model for predicting synergy effects between two drugs was proposed by the project entitled **"Investigation of adaptive design and rewiring of Survival-Apoptosis-Mitogenic (SAM) signalling transduction network" (SAMNets, MSCA-IF).** In this project, the focus was on on proteins involved in the oncogenic RAS pathway, which appear mutated in

more than 30% of all cancers. Several therapeutics have been developed that target members of this pathway, but in many cases, tumors acquire resistance. Researchers in this project developed an innovative deterministic algorithm that integrates all the proteins' structural features in this pathway and their conformational interactions to existing drugs. In doing so, they predicted the combination of two drugs debilitating the pathway at different layers and in a way that mutations cannot bypass. Proof-of-concept data in tumor cell culture provided an additional bonus: a lesser concentration is required when two drugs are combined - hence less pressure upon the tumor to mutagenise itself - than when drugs were used independently of each other. This approach holds great promise for cost-effective therapeutic solutions since existing and approved drugs are being combined. In contrast, structural prediction can be upgraded by combining deterministic algorithms with artificial intelligence. The main obstacle is the need of companies to develop new drugs and their unwillingness to support combinatorial therapies if one drug stems from another company.

In the forefront of innovations for destroying tumors on site, the **"Photo/magnetic stimulated nanocargos for superior cancer treatments (NANOCARGO, MSCA-IF)** project researchers developed magnetic nanoparticles with a modified shell for killing *breast cancers*. Unlike projects focusing on nanoparticles' magnetic core, NANOCARGO invested in modifying their outer shells. These "plasmonic" shells can simultaneously accept biological polymers that can bind to breast cancer cells; and anticancer drugs to be released when triggered by alternating magnetic fields and hyperthermia. In general, "nanotherapeutic" technologies have a high commercialisation interest from international and regional companies and hold promise for several solid cancers. NANOCARGO won the 2020 Innovation Radar Prize as one of Europe's most promising innovations emerging from EU-funded research and innovation projects.



Several other nanotherapeutics were presented in the **poster session**. For example, the MSCA-IF project **NANORNA PC** engineered protein coronas on RNA nanoparticles for improved delivery of nucleic acid-based therapies. The MSCA-ITN project **HeatNMof** project highlighted the suitability of metal-organic frameworks of nanoparticles in drug loading and release. The MSCA-COFUND project **iCARE2** assessed the nature of the mechanical interaction between nanoparticles and cells and how cancer cells' movement affects these interactions. The MSCA-RISE project **OXIGENATED** project explored methodologies for capturing hemoglobin to nanocarriers aiming to carry oxygen into tumors where it can be metabolised into its toxic form by irradiation. Finally, the MSCA-IF project **NANOTAM** project focused on nanoparticles capable of reprogramming tumor-associated macrophages to kill the tumor instead of supporting its growth.

Other anti-tumor technologies presented in the poster session included: MSCA-ITN project **OMA**, which employed ion beams to induce DNA damage of cancer cells; MSCA-RISE project **INPACT**, MSCA-IF project **BRAINHIB** and EitHealth project **PEPTOMYC**, which developed specific peptide and lead compound cargos that can act at a single cell level to prevent metastasis or targeting the *myc* oncogene; MSCA-ITN project **THERADNET** engaged into innovative radiotherapeutics; and MSCA-RISE project **FourCmodelling** which develop algorithms based on game theories to anticipate treatment-induced resistance for more educated "evolutionary" therapies.

## Critical challenges in drug development and therapy

Captured here are the challenges extracted from the panel discussion showing the main obstacles in drug development and therapy echoing the diagnostic field gaps in training and connection to industry, although in this research area patient involvement seems more relevant.

**#1 Efficiency in intersectoral communication.** The heterogeneity of cancers, the differences in investment in different research areas, the need for personalised approaches, and the gaps in the generation of industrial products for clinical management are significant challenges in cancer research. To face these challenges, researchers at different levels and sectors need to communicate more efficiently with each other (e.g. biomarker and therapeutics communities) by sharing common grounds and expertise (e.g. academic researchers, industry, healthcare providers), and by integrating innovative approaches (e.g. artificial intelligence and engineering). Policy-makers need to further consider more holistic strategies in funding and finding ways to achieve alignment of international and national efforts across sectors.

**#2 Strengthening translational programmes.** Most academic innovations in therapeutics neither reach the industry nor the clinic, and many of those innovations that do go forward eventually fail during Phase I Clinical Trials. One possible reason is the lack of translational research supporting the conversion of an academic research finding into industrial interest. To meet industrial and clinical standards, fundamental research needs to provide reliable, robust, and benchmarked data via accurate pre-clinical platforms. This may overcome bottlenecks in drug development and facilitate the communication and sharing between academic and pharmaceutical industries. However, academic researchers face difficulties attracting investors for such proof-of-concept research because it is considered high risk. Funding agencies – including the EU – should consider investing in projects of pre-industrial and pre-clinical transition. Moreover, SME's participation, which can act as liaisons or catalysts in such development, should be significantly encouraged.



**#3 Fostering industrial training for academic researchers.** As is the case for biomarker research, academic scientists often do not have the skill set necessary to develop a final product. Although researchers in therapeutics are more successful in gaining the attention of industry, they still need training on the procedures and standards that need to be met for industrial engagement and the emergence of shared interests. Therefore, besides the need for schemes that bring researchers and investors together, efforts should be made in the actual participation of trainees in industrial and pharmaceutical laboratories to understand standardisation, benchmarking, quality control, manufacturing and production.

**#4 Patient awareness at regional level.** The perspectives of patients on the academic research efforts towards clinical drug design are essential. Patient organisations' attention on academic research should be increased beyond the consent of patients in providing source material. EU-funded projects foresee and insist on the engagement and involvement of patient organisations. However, regional efforts in EU Member States need further enhancement.

**#5 Impact of the COVID-19 viral pandemic.** The worldwide COVID-19 viral pandemic had a manageable yet disruptive effect on many networking

interactions. However, it also provided opportunities for strategic thinking. For example, cancer patients' increased susceptibility to the COVID-19 virus highlighted infection as a susceptibility parameter that should be considered for future collaborative research schemes.

## 3.3. MSCA projects in Immunotherapy

Undoubtedly, strategies that boost the body's immune system to attack tumors expand our armamentarium for targeted and personalised approaches. Cancer Research in immunotherapies has made a substantial impact at pre-clinical and clinical levels. The MSCA strongly support immunotherapy research, with 10% of funded projects in cancer addressing this topic (**Annex A**), and aligns itself with international cooperative efforts for alliances with other schemes and regional efforts (e.g. TRANSCAN). However, **several challenges need to be addressed for such therapies to replace surgery, chemotherapy, or radiation therapy**. These include: (a) the **effect of immune infiltrates**, which varies extensively between tumors; (b) the escape of tumors from **immunosurveillance**, which can lead to patient unresponsiveness, especially for solid cancers; (c) side effects occurring due to **immune overactivity**, or "autoimmune" like off-tumor toxicity in heterologous tissues (e.g. neurotoxicity of CD19 CAR-T's raised against *blood cancers*).

A vital issue in immunotherapy is the proper selection of tumor-associated antigens expressed exclusively on the tumor cells' surface that the immune system can see; and neo-antigens that emerge through passenger mutations and allow tumors to escape immunity. The characterisation of either, or both, is essential for the engineering of immunotherapy strategies using monoclonal antibodies or adoptive cell therapies using native or chimeric antigen receptor T-cells (CAR-T cells), especially against untreatable solid tumors like *glioblastomas*. The project **"Blocking Inhibition of T-cell Co-stimulation for Anti-tumour Therapy" (BITCAT, MSCA-IF)** used *in silico* data identification and mutational optimisation of antigens expressed by glioblastomas, which can then be used for the design of high-affinity and antigen-specific chimeric TCRs. CAR-T cells engineered for such antigens effectively eliminated *glioblastoma* and other tumor cells in culture and showed promise against a pre-clinical tumor engraftment model.



Another challenge in CAR-T-cell therapy is how to enhance the activation properties of the chimeric T-cell receptor and hence T-cell reactivity when it meets a tumor antigen. Research under the **"European Network on Anti-Cancer Immuno-Therapy Improvement by modification of CAR and TCR Interactions and Nanoscale Geometry" (EN_ACTI2NG, MSCA-ITN)** focused on the intracellular complexes formed when the T-cell receptor engages an antigen to identify interaction domains that could be used to enhance the capabilities of engineered CAR-T cells. They identified a motif in a subunit of the CD3 coreceptor, which interacts maximally with the key signal-transducing kinase Lck. Introducing this motif into the intracellular domains of a CAR-TCR enhanced the corresponding T-cells' anti-tumor function in pre-clinical models of *acute lymphogenic leukemia*. The way forward is to check whether CAR-T's engineered with such modified intracellular motifs are sensitive enough to target tumors with low-antigen density to prevent antigen-negative relapse. This study underscores the need to fund primary research efforts in the fundamentals of immune

signaling and explain how such basic knowledge can lead to cancer immunotherapies' rational improvement.

In another form of adoptive cell therapy, native T-cells are isolated from the patient and then are exposed to tumor cells from the same patient to act as antigens. Following identification of reactive T-cells outside of the body, they are introduced back into the patient to confer tumor immunity. This approach has been beneficial to an extent to melanoma patients. However, such T-cells are usually very heterogeneous, and since the actual antigens are unknown, it is challenging to enrich those having maximal anti-tumor activity. To circumvent such a problem, the project **"In-depth profiling of neoantigen specific-lymphocyte subsets with superior traits for personalized Tcell therapies" (BP3, MSCA-COFUND)** used multicolor flow cytometry to analyse the phenotype of lymphocytes infiltrating *endometrial cancers* from forty-seven characterised female patients. Using a battery of known T-cell activation markers, they identified that tumor-infiltrating T-cells expressing the PD-1 and CD39 markers correlate with better prognosis and have better tumor recognition capabilities. Markers derived from such screens can be readily translated to any clinical hematology lab setting and for other tumor-associated cells currently analysed via single-cell "omic" approaches.

The **"Immune DIREcted and Cancer-selective immunoTherapy" (I-DireCT, MSCA-ITN)** project aims to provide very specific immunotherapeutics for *Epithelial Ovarian Cancer, Acute Myeloid Leukemia*, and *Non-Hodgkin Lymphoma* devoid of "off-target" side effects. The project aims to design monoclonal antibodies that can act like checkpoint inhibitors by binding to a proliferation signaler on tumor cells (e.g. EGFR); and at the same time bind on a costimulatory molecule on invading T-cells to maximise their activation. The specificity and the efficiency of this specific bridging effect gave promising results in cell culture systems. To enhance the delivery of such immunodrugs, the project provided data on novel, calcium-containing (vaterite) nanoparticles that released the drugs on target due to pH changes.



A wide range of innovations to increase the potential of immunotherapy were presented in the **poster session**. For example, the MSCA-IF projects **InTheMLLrBALL**, **THAT IS HUNT,** and **AVITAG** as well as MSCA-ITN project **META-CAN** employed next-generation and scRNA sequencing for CAR-T cell and oncolytic design virotherapies against *leukaemias*, *glioblastomas* and p*ancreatic adenocarcinoma.* Moreover, the MSCA-ITN projects **pHioniC**, **T-OP**, and **TRAIN** projects brought together interdisciplinary expertise in oncology, bioinformatics, immunology, and protein engineering to better understand tissue and cell microenvironments with tumor development, including the pH landscape and the regulation of cellular pathways focusing on cytokine signallers. Finally, considering the need to predict responses to immunotherapy, project MSCA-IF **IMMUNOMARK** has identified efficient biomarkers and has developed a logistic regression prediction model using multiple transcriptomic, genetic, and epigenetic data.

## Critical challenges in immunotherapy

Immunotherapy is by definition a personalised type of approach and therefore the challenges in costs, inequities and need for patient involvement were clearly articulated in the discussion as summarised here.

**#1 High cost research.** The development of immunotherapies requires broad scientific, clinical, medical, and industrial expertise, together with solid IP protection and ethics management since it is strictly a personalised approach. As such, it is a costly endeavor and requires extensive mobilisation of resources. Therefore, there is a real need to increase researchers' awareness on funding policies, especially in underdeveloped regions with more limited resouces and capabilities. Also, so far, the approach is researcher-initiated when formulating new cooperation networks, and this requires facilitation.

**#2 Engagement of patients.** At the early stages of research, and most especially in basic exploratory research, there is a challenge in involving patients. In most cases, however, they become involved through their attending physicians who have a greater interest in research. On the other hand, when research findings become known, patients with a high interest in immunotherapy clinical trials can mobilise funding at the local level. The challenge is to use targeted public outreach measures to reach all patients who would further search and push for funding.

**#3 Inequity in accessing immunotherapies.** Some institutions are already members of TRANSCAN actions and publicised towards their research faculty. However, there is a need for improvement of international collaborations. In addition, there is an extensive variability in the cancer charity ecosystem, and the challenge is to bring them on board. This is an additional challenge for immunotherapy since it has not progressed to clinical trials as other approaches have. Also, the criteria for low or middle income regions should differ or alternatively formulate targeted calls for such regions. Given the high cost and resources required for immunotherapy, its application is restricted to a limited number of hospitals, whereas most healthcare systems cannot support it. This may become a problematic barrier considering the priorities and financial capabilities of different regions across the EU Member States. This is also due to elaborated regulatory frameworks that small hospitals or clinics cannot support.



**#4 Access to clinical data.** Immunotherapy is essentially a personalised therapy. It requires disclosure of a variety of data relating to the patient's immunological profile and the tumor. Currently, there are no clear guidelines on collecting, protecting and accessing such data. As for other data, healthcare organisations should be encouraged to form teams of personnel trained in the cycle of "data mangagement" including proper collection, annotation, and curation of data from many different modalities (imaging, hematologic, genetic, genomic, etc.). In parallel, the EU and Member States should provide directives that support healthcare providers and guide hospitals and other relevant organisations on how to manage such departments internally, advising them on data handling issues in order be able to help researchers while protecting patients' rights.

## 3.4. MSCA projects on Prevention and Personalised Medicine

Primary prevention decreases the risk of developing cancer or relapsing to cancer. A balanced nutrition, exercising in a healthy environment, vaccination, and education to increase health awareness are the main traditional activities focusing on prevention of cancer. In the context of "**personalised health" activities in preventing cancer**, considerations to be addressed include: (a)

the **definition of healthy status and its relation to changes in microbial symbiotes** (i.e. microbiomes) that could facilitate cancer progression, (ii) the **establishment of large screening programmes** and biobanks for a variety of cancers, (iii) the **monitoring and rehabilitation of cancer survivors**, (iv) the **alignment of healthcare systems to multiparametric strategies** ensuring prevention and improvement of patients' quality of life.

The project **"A novel integrative strategy to prevent colorectal cancer within the diet-host-microbiota triangle: from organoids to human in vivo reality" (TRIANGLE, MSCA-IF)** focused on the prevention of *intestinal cancers* via a nutritional approach that exploits the metabolic capabilities of the gut microbiome. The project considered the gut microbiome as a factory which converts diets rich in fiber or phytochemicals to metabolites capable of killing tumors. To demonstrate this, they used three food models (rich in either cellulose, pectin or apple) for testing either *in vivo* or used metabolites to assess their effect upon human colon organoids and tumoroids. Moreover, the project devised a multi-omic approach to identify functional interactions between the genetic makeup of the host or the cancer patient, their corresponding microbiomes and the metabolites of these microbiomes. As noted in the discussion, more research is needed to define the nature of a "healthy" gut microbiome and how this is altered due to diet and in individual cancer patients. This can be facilitated by innovations in biobanking human colon organoids to be used as a research tool.

The **"Transcriptomic landscape of ovarian cancer through mRNA sequencing" (ImPRESS, MSCA-COFUND)** project used transcriptional profiling (i.e. RNA expression) to screen samples of tissue, blood and serum from patients with *ovarian cancer*. Following several layers of bioinformatic analyses it revealed novel molecular biomarkers that could be used for disease monitoring. The project also performed a parallel transcriptomic screen on cancer stem cell subpopulations and tumoroids to identify genes that support stemness, metastasis or drug resistance. The project highlights the importance of generating "big data" derived from patients which, if accessible, can lead to a better understanding of individual cancers and efforts for predicting, preventing or treating patients at a personalised level. Developing a screening programme for ovarian cancer is a must; however, it has a long way to go because more specific biomarkers need to be identified. Patients are reluctant to participate in holistic genomic programmes to expose their genetic traits and omics approaches still have a high cost.



Besides holistic genomic data, protein modifiers of cellular metabolism that are altered in cancer cells can also be explored for preventive and diagnostic screening as indicated by the project entitled **"Deciphering the Metabolism of Haematological Cancers" (HaemMetabolome, MSCA-ITN).** The project used analytical mass spectrometry (MS) and nuclear magnetic resonance (NMR) techniques to screen *leukemias* for unprecedented changes in glycolytic versus oxidative metabolism and their rewiring in drug cases susceptibility or resistance. In doing so, scientists identified specific metabolic programmes that differed amongst *leukemias* (e.g. Acute Myeloid Leukemia versus Chronic Lymphocytic Leukemia), they identified distinctive metabolic gatekeepers that support drug resistance in AML that can be targeted, and the restoring effect of exogenous metabolites towards drug susceptibility. More research is needed to connect genetic and epigenetic changes to the metabolic rewiring of tumor cells and the

impact of the tissue microenvironment on tumor cell metabolism. Still, for the prevention and treatment of *heterogeneous blood cancers like AML*, the metabolic assessment of individual clones from patients can be an efficient and personalised strategy. Moreover, it is low cost and can be scaled up for population screening. This is because it requires established hematological techniques, like flow cytometry for isolating clones, and there are a number of low cost lab or flow-based options for measuring metabolites at single cell level.

Focusing on the wellbeing of cancer patients, the **"Outdoor against Cancer: move yourself, go out and live!" (OAC: my goal, ERASMUS+ programme)** project aimed to create awareness about the health-promoting effects of outdoor activities. The main objective was the spreading of information about the benefits of outdoor sports activities in cancer care and the availability of specific programmes for young cancer patients. The project delivered different international outdoor events that were monitored by certified trainers, each of which abided by the guidelines of an OAC training manual. The wellbeing of the patients was observed and the results demonstrated an apparent positive effect, even in medical terms. The project went on even during the COVID-19 pandemic with online opportunities for exercising at home. It highlighted the massive importance of after-care and the position of outdoor and exercising activities, both for prevention and treatment.

The **poster session** included additional innovations and individualised strategies for cancer prevention and therapy. For instance, the MSCA-ITN project **GLIOTRAIN** applied an 'omics' approach and computational data analysis to reveal the diversity and heterogeneity of individual *glioblastoma* tumor cells and developed relevant *in vitro* and *in vivo* models for personalised screening of treatment strategies. Similarly, MSCA-ITN project **TRIM-NET** determined the mechanism of actions of Tripartite Motif (TRIM) proteins in *prostate cancer* enabling the development of novel therapeutics. On the other hand, MSCA-ITN **CANCERPREV**, focusing on *breast cancer* prevention, investigated the mechanism of epigenetic aging and highlighted its potential to be used as a prediction model for patient's health or disease status.



## Critical challenges in prevention and personalised medicine

Like immunotherapy, personalised medicine and preventive strategies have their cost and uptake challenges and much room in the future for closer collaborations between practitioners, researchers and policy makers. The main challenges idenfied in the panel discussion are summarised here.

**#1 Implementation of personalised medicine**. The benefit of novel technologies, such as single-cell sequencing and emerging organoid technology, could facilitate personalised approaches to cancer prevention, treatment, and care. The implementation of these technologies could enable a deeper insight into patient-specific biology, support the identification of individualised biomarkers, and enhance targeted screening and prevention strategies.

**#2 Cost of personalised strategies.** Attention should be paid to potential inequalities in access to the sophisticated and expensive personalised cancer prevention and treatments. In addition to robust ethical considerations, cost-efficient strategies that could decrease development costs and improve success rate should be supported to implement personalised medicine and prevention strategies at a population scale. It is essential to enable people living under

different economic circumstances to access high-quality customised diagnosis, prevention, and treatment. For instance, the potential of flow cytometry and PCR (polymerase chain reaction) technologies, which are cost-effective and have already been applied in diagnostic laboratories, were suggested to be maximised by identifying specific individualised cancer-related cell markers to be used in personalised medicine.

**#3 Communication between policy-makers and academic scientists**. Strengthening collaboration and communication between policy-makers, healthcare providers, and scientists is a top priority to tackle cancer-related preventive and therapeutic issues effectively. It is essential to enhance all channels of communication to scientists within the regional, national and international healthcare sectors, thereby mobilising the collective power of scientists and healthcare providers, and ensuring that patients across the EU can benefit from better cancer care and treatment.

## 3.5. MSCA projects on Quality of Life of Patients and Survivors

While significant advances in cancer prevention, early diagnosis and treatment have proven to improve the control of cancer development and survival rates, the general quality of life of patients and survivors is overlooked or addressed to a lesser extent. To efficiently narrow this "survivorship to quality of life" gap, MSCA projects addressed initiatives focused on: (i) **facilitating innovative and effective interventions to monitor patient's physical and mental problems**; (ii) **connecting patient with healthcare providers and complementary sectors** such as palliative care, social care, and e-HEALTH; and (iii) **empowering patients to manage their own health**, leveraging digitalisation and personalised technologies.



Focusing on the value of rehabilitation on improving quality of life of patients and survivors, the project **"Activating Technologies for Connected Health" (CATCH, MSCA-ITN)** taps into the potential that personalised technology offers to bridge the gap between patients depleted physical and emotional state and their ability to return to the pre-cancer level of functional independence and capacity through technology-enabled rehabilitative approaches. CATCH's innovative outcomes include a novel neuromuscular electrical stimulation tool for muscle strengthening and the 'Cara-Rehab-Tech' digital platform, enabling real-time monitoring of patients performing home exercises. These interventions' advantage lies in the gamification-based approaches that strengthen the patient's motivation and engagement to physical activities. In addition, the project addressed the need to deeper understand the physical and emotional challenges cancer patients face and collaboratively work with them to facilitate individualised interventions. Transferring research outputs into sustainable healthcare solutions by enabling the large-scale follow-up evaluation of interventions remains an important challenge.

As particular cancers became a chronic disease, living with cancer also requires ongoing everyday disease management approaches. The project **"Digital integration of Psychosocial Care and Health Education services" (ONCOMMUN, EITHealth)** developed online solutions through the digitalisation of psychosocial care and health education services, to daily support patients and survivors outside the hospital environment. As addressed by the ONCOMMUN

project, inequality on psychosocial care access remains a significant barrier to patients' quality of life, as only 15-20% of patients experiencing emotional distress have access to psychosocial care. ONCOMMUN is an innovative digital ecosystem that combines well-established technologies comprising online screening and monitoring tools, online support communities, and online therapy and psychosocial care. ONCOMMUN strategies led to significantly reduced psychotherapeutic medication and days of sick leave. On the other hand, healthcare approaches based entirely on *e-Health* and computer-data approaches could also lead to inequalities concerning access by older people and patients with comorbidities. Overall, as it was addressed by ONCOMMUN and the Commission Initiative on Breast Cancer action, it is essential to incorporate only evidence-based implementation; otherwise, there is a risk of confusing patients, increasing their emotional distress. A strategy similar to the one presented by project ONCOMMUN was also presented in the **poster session** by the project **"Holistic health apps for chronic disease management" (WEFight, EITHealth).**

To improve communication between patients and healthcare professionals, the project **"TACTIC - TAiloring the Communication of risk To Individual breast Cancer patients" (CAROLINE, MSCA-COFUND)** has developed an innovative tool to aid *breast cancer* patients' understanding of disease risk factors, diagnosis, and treatment options, while in parallel aiming at improving shared decision-making between patients and healthcare professionals. Making diagnostic results and treatment more understandable empowers patients to take more control of their own health and it improves their quality of life by reducing their anxiety. As noted by the project speaker, one of the most crucial challenges here is the lack of universally applied electronic health records. The CAROLINE project has developed a Cancer Treatment and Survivorship Care Plan modeled on a health passport concept to face these barriers. This plan provides a foundation for adaptations to digitalisation and aids in shared decision-making in clinical settings. Moreover, CAROLINE identified groups of patients underrepresented in clinical trials, such as older adults, people with comorbidities, or people of lower educational attainment. It addressed the need to empower them to better understand their condition and to participate in clinical trials. During the panel discussion, two key aspects were highlighted: the need for patient-centered healthcare approaches and for multidisciplinary meetings, where patients can communicate at the same time with specialists of different healthcare areas such as chemotherapists, radiologists, psychosocial assistants, nurses, and maybe a family member.



Furthermore, the project **"RADIOGENOMICS: Finding Genetic Functional Variants Through Fine Mapping" (RADIOGENFF, MSCA-IF)** connected the poor quality of managing cancer's long-term effects to genomic and genetic variations to provide solutions for maximal and long-standing personalised care. RADIOGENFF identified through fine-scale mapping genetic loci associated with the development of radiation-induced toxicity phenotypes. The knowledge obtained will generate a predictive statistical model for identifying patients, before being treated with radiotherapy, that are more likely to develop severe radiation-induced toxicity. Although, genomic aspects in cancer prevention, diagnosis and treatment have been mentioned in the updated European guidelines on breast cancer screening, there is a gap between how genomic evidence could be substantiated and then proposed to be included into the guidelines. Goals similar to the project RADIOGENOMICS were also shared by the

MSCA-ITN projects **ElectroPros** and **BonePainII** presented in the **poster session**.

## Critical challenges in quality of life of patients and survivors

This is a critical and highly interdisciplinary part of cancer research and the key gaps in understanding the issues and implementing solutions are reflected here from the panel discussion.

**#1 Understanding the holistic needs of all subgroups of patients exposed to cancer.** To leverage such holistic approaches requires strong engagement from all EU-members and policies to facilitate ongoing support to patients during the whole cancer journey, before and after treatment. Also, considering that many cancers are preventable, additional efforts should be made to properly educate citizens early on in their lives through the school setting. Moreover, initiatives and platforms such as the European Health Data Space and the European Open Science Cloud can include data on nutritional and lifestyle factors from a broad spectrum of cancer subgroups across EU Member States in support of interdisciplinary coalitions to meet patients' needs.

**#2 Bridging research-to-practice gap.** Research related to the quality of life of cancer patients and survivors should reach the healthcare settings and citizens. This remains a big challenge, as a one-size-fits-all policy could not be used on patient care. Therefore, patient-centered multidisciplinary approaches involving collaborations with a wide variety of services need to be deployed.

# Chapter 4 – Meeting Conclusions

## 4.1 Summary of the outcomes

During the two-day event, the invited project speakers presented their work and highlighted their contribution to European cancer research and innovation overarching strategy.

The added-value of MSCA to *interdisciplinary research* was particularly evident in the session about cancer diagnostics, where scientists from different fields (e.g. physicists and materials chemists) reach out to work with bio-medical specialists to design new tools and assess their impact. In the field of drug development, the contribution of MSCA, especially RISE, was praised for the opportunity it gives to reach out for experts and to have an integrated approach to establish networks that include SMEs, big pharma, clinicians and patients. The role of MSCA funding in immunotherapy research was acknowledged as perfectly fitting within the wider EU funding scheme together with other instruments, in a coordinated approach with Member States to increase cooperation with national research policies and programmes. In the panel about prevention and personalised medicine, MSCA ITN was commended for fostering diversity of expertise through networks and bringing stakeholders together (*'stronger together'*), and fostering even larger networks was advocated by some of the panellists.

In terms of *innovation potential*, the excellent scientific quality of the projects and their focus on intellectual property was acknowledged by the MSCA Cancer Cluster Experts. Researchers are protecting their results appropriately thanks to the involvement of the technology transfer offices at their respective institutions yet adhereing well to the open research spirit and obligations of their grants. In Horizon 2020, data management plans in research were included to support the Open Research Data Pilot as part of the grant obligation.



In Horizon Europe data management plans will be mandatory. This could establish a good first step to building the necessary capacity and guidelines for clinical settings and personnel. The European Commission should invest further in enhancing the *exchange with industry* representatives and investors, as well as in handling intellectual property rights and confidential information. Gaps were identified on involving industry and therefore some incentives should be introduced to facilitate inter-sectoriality of the action and understanding of common grounds. Regardless of the area, both panellists and participants acknowledged this need. While some academic researchers attempt at times to approach industry representatives, they do not seem to be equipped with the necessary skill set. MSCA programmes like ITN and RISE have always strongly encouraged the cooperation with industry. The new MSCA Programme within Horizon Europe will continue on working in this direction, as one of its expected impacts will focus on establishing sustainable collaboration between academic and non-academic organizations. For example, the MSCA Postdoctoral Fellowships (successor of the Individual Fellowships) will fund an additional period of up to six months to support researchers seeking a placement at the end of the project to work on R&I projects in an organisation from the non-academic sector.

On communication between academia and industry, interesting opinions were expressed in the meeing feedback survey (**Annex E**). While it was acknowledged

that researchers should understand the needs and interests of the industry, on the other hand there were some interesting comments showing that not everything has to be oriented to industry as basic research, independent from industrial interests, is key to advance knowledge, independently on immediate applications.

*Digitalization* was mentioned as a key enabling tool in various aspects of fighting cancer. From a more tangible simplification associated with data sharing and database creation within and among Member States, other innovative examples were provided. Online cancer communities offering possibilities to speak up and interact anonymously, help to overcome the issues around cancer-related fear and associated stigma. Digitalization of health care provision and self-care facilitated health and mental health management outside the clinical setting during the past year of the corona crisis. While in general, digital tools are becoming more available, thus enabling better access to the necessary support, there are still disparities and limited access for disadvantaged people, elderly, and minorities that need further attention.

A subject of discussion was *cancer vaccination*. This new therapeutic approach was discussed in a couple of panels and the agreement was that for some cancers, whose infectious origin is known, vaccination can be considered as an effective treatment, as already happening for cervical cancer (e.g. HPV vaccine programme). A large majority of the participants to the survey considered that an anti-cancer vaccine could be developed in the future. However, while some supported the development of vaccines others considered that focus should be on development of drugs as opposed to vaccines. At the same time, the politics of the life style and their influence on the probability of cancer occurrence, including preventive measures, should be explored further. Moreover, some suggested that the immune mechanisms of evasion do not allow the development of vaccines in cancer but that such investigations could allow researchers to get adequate immunotherapies different to the vaccine concept, as a preventive method.



When asked about the focus of the European Commission's future cancer policies, the participants shared the following interesting suggestions:

- It is important to understand changing societal requirements and behaviours to target the right populations and to have 'blue sky' research in order to have research that is beneficial to society not just industry;
- Environmental factors in cancer occurrence (e.g. chemical contaminants) or prevention (e.g. diet/lifestyle), as well as surveillance of long term health effects (secondary and tertiary) for cancer patients should be given higher consideration;
- To avoid dispersion of knowledge and to improve coordination between researchers, EU Programs and Policy Makers, a way forward could be to coordinate these activities to streamline a common action plan. This would avoid stand-alone actions to maximize impact.
- Although personalized medicine is perceived as the future in many cancer therapies, some concerns were shared on its applicability. A misinterpreted concept of privacy and sharing biological data, economic associated burden, together with deterioration of public health systems across EU (and increasing privatisation of medicine) represent barriers that might

favour wealthier people that would have more probabilities to access personalised medicine.

- Challenges in the communication between patients and health care professionals need to be addressed; additional support and material must be provided to the patient to understanding clinical trials.
- The idea of cancer coaches was brought up in the context of European guidelines which include evidence based recommendations for promoting patient involvement and patient advocacy; drafting specific recommendation for involving coaches in after care activities was suggested.
- The impact of the current COVID-19 pandemic on cancer patients was also discussed. Although academia and industry showed resilience and flexibility, which limited the impact on projects implementation, the crisis delayed access to treatment and screening programmes, which further deepened inequalities.
- A holistic approach to improve the quality of life in cancer patients should be promoted; working in silos is no longer possible, and all policies should include health.

These suggestions match well those identified by the MSCA Cancer Cluster Experts. There is clearly more than technology to consider and that the human dimension and equity to access care are priorities for EU cancer policy.

**Nurturing collaborations with the different sectors of the European Commission** is one of the most important outcomes of this MSCA Cancer Cluster Event. Understanding the needs and interests of policy makers by researchers was confirmed as critical, but how to promote this communication is still not necessarily clear. For this reason, the event was very much appreciated, as it provided an opportunity in bridging the gap. The organization of similar events to facilitate the dialogue, was advocated both by panellists and participants in the Survey. The idea of creating best practices to assist this bilateral communication (researchers to/from policy makers) and to avoid duplication of efforts in creating always new communication measures was also identified. The projects were recognized by the MSCA Cancer Cluster Experts as fully aligned with both the goals of the HE Cancer Mission and the Europe's Beating Cancer Plan, showing the potential to contribute significantly to policy development.



For the Policy Officers, it is important to be in touch with the actual subject matter and outcomes of research funded by EU. The MSCA Cancer Cluster Event helped confirming the idea that the contribution of the MSCA programme to research and innovation is strong and it is more than an action aiming at training and mobility. As a bottom-up programme, one of the strengths of the MSCA is the enablement of researchers to contribute to joint policy-making through their high-quality results and fresh ideas. For this, a careful mapping of the MSCA cancer project portfolio is central to harnessing the programme's potential, given the extensive EU investment and variegated nature of the programme (**Annex A**). Equally, the contribution of the MSCA programme to high-quality training is an essential component of the *Excellent Science* strategy. While enhancing talent and knowledge is one of the pillars of the MSCA programme, specialized trainings of health professionals in new clinical trials and diagnostics remain an important need. The HE MSCA Programme will work in this direction "*to match the future*

*needs of the labour market, to innovate and to convert knowledge and ideas into products and services for economic and social benefit".*

## 4.2 Event feedback

The event feedback survey (**Annex E**), was a useful tool to confirm the audience satisfaction of the event and that the objectives were successfully met. The participants liked the fact that the event covered various aspects of cancer research, from diagnostics to quality of life. The participants appreciated the presentations by the European Commission representatives who raised awareness of the consultation processes and provided information on a wide range of EU funding opportunities, including public-private initiatives, addressing both specific topics and bottom-up approaches. The overall success was evident during the meeting through the dynamic discussions captured by our MSCA Cancer Cluster Experts which followed the excellent presentations and posters prepared by the MSCA fellows and coordinators and EC colleagues .

To encourage a good level of visits for the e-poster session, we set-up a contest (by voting of visitors to e-poster exhibit) of the "best e-poster". There was a total of 34 posters presented, with a total of ~1200 video downloads/viewing (**Annex C**). Out of 605 total votes cast, the majority of votes (393 votes) were for the project "MAGNAMED" – "Novel magnetic nanostructures for medical applications" (H2020-MSCA-RISE-2016; Grant No. 734801), coordinated by Dr Rafael Morales, who was presented with the award at the meeting closing session by the Head of Department for the MSCA, Begoña Arano. Dr Morales stated "*We are very happy with this award. It is a great motivation for the consortium to continue participating in dissemination activities for the general audience. MSCA is an excellent programme to collaborate with international organizations, but these open events are also necessary to let people know what we do in our labs and inspire young students*."



In the survey, the respondents provided further inputs on policy-related questions that were useful in drafting the final list of challenges and to extract the priority needs (**Box 1**, pg 10) for policy consideration. Finally, the feedback survey showed that the virtual format was successful and appreciated, although it cannot replace the face-to-face interactions for the networking between the panel discussions and at the poster sessions. In the future, a hybrid format may be considered to keep elements of the virtual format when hosting a live event.

## 4.3 Future directions

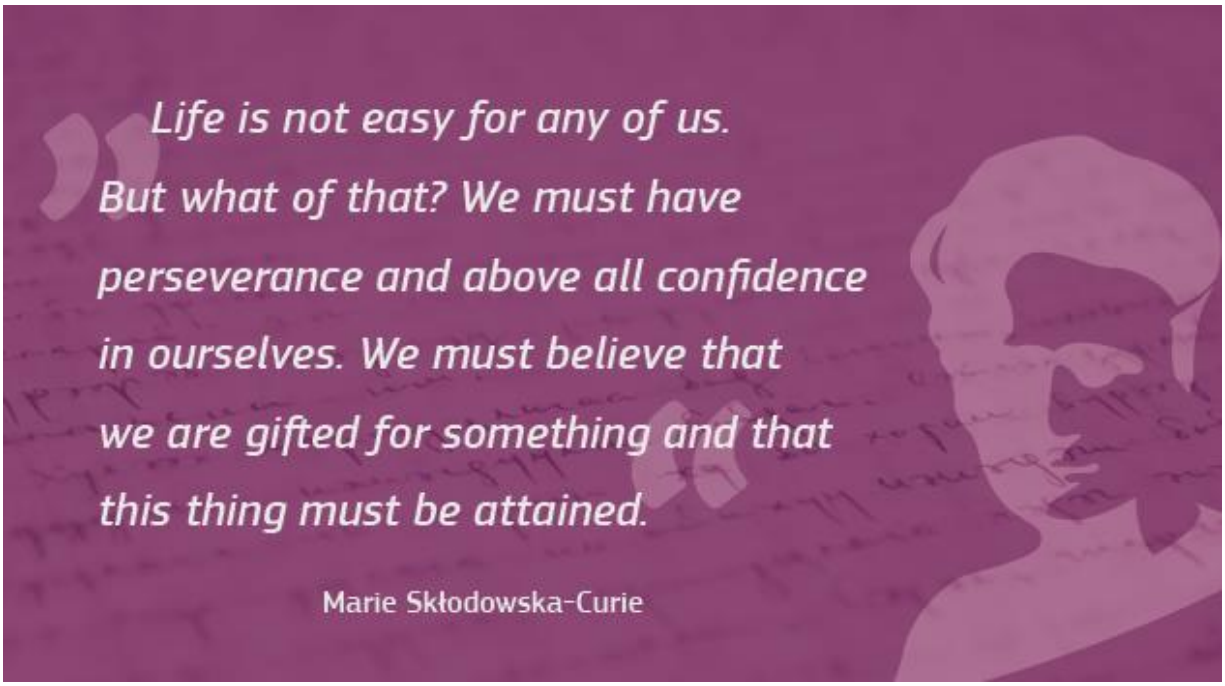
This meeting was a pilot in its fully online organization. It successfully reached more than 800 people (including 166 MSCA Researchers and Coordinators), which is a great improvement compared to the last MSCA Cluster Event organized in person. Participants to the MSCA Cancer Cluster Event joined from all over Europe (panelists and experts) and from various other countries in the world (**Annex B**) without the costs of travelling, a substantial achievement in the context of the Commission's main commitment with regard to reducing its energy consumption.

This was the second joint MSCA Cluster Event organized at REA and the feedback is convincing that this format is a **successful means to provide feedback to policy**. Bringing together top researchers, project success stories in cancer research and leads in policy fields allows for new contacts, new research ideas and new collaborations between scientists. More striking, as acknowledged by several panelists, was this unique opportunity for scientists to get in touch with the EC institutions and to exercise in understanding, engaging and reacting to policy makers to be aligned with the most current policy needs.

We are thankful to the very enthusiastic and committed researchers and coordinators who accepted to join this event and share their work.

We would like also to thank the representatives of the Directorates General for Research and Innovation (DG RTD), Energy (DG ENER), Education, Youth, Sport, and Culture (DG EAC), Health and Food Safety (SANTE), the Joint Research Centre (JRC), as well as of the EIT Health and Innovative Medicine Initiative (IMI). They helped align this event with the European Commission policy agenda and kindly accepted to give presentations, lead the discussion as moderators, or contributed to the policy discussion.

The meeting is concluded *via* the publication of this report, however we expect that the interaction between policy and scientific community generated by this event will continue to grow through exchanges and networking. The organiser intends to keep the participants updated on developments via EC social media channels and possible future events coordinated by REA in collaboration with our policy DG colleagues.


Life is not easy for any of us.
But what of that? We must have
perseverance and above all confidence
in ourselves. We must believe that
we are gifted for something and that
this thing must be attained.
Marie Skłodowska-Curie

# Useful Links

- Cancer burden statistics and trends across Europe | ECIS (europa.eu)
- Commission Initiative on Breast Cancer action
- CORDIS | European Commission (europa.eu)
- EIC Accelerator (europa.eu)
- EIT Health | Promoting innovation in health
- Erasmus+ | EU programme for education, training, youth and sport (europa.eu)
- European Guidelines on breast cancer screening
- European Health Data Space
- European Open Science Cloud
- European Strategy Forum on Research Infrastructures (ESFRI) | European Commission (europa.eu)
- European Week of Sport | Sport (europa.eu)
- Europe's Beating Cancer Plan (europa.eu)
- Funding & tenders (europa.eu)
- Health-EU e-newsletter - European Commission (europa.eu)
- Homepage | IMI Innovative Medicines Initiative (europa.eu)
- International Consortium for Personalised Medicine - ICPerMed
- IRDiRC – International Rare Diseases Research Consortium
- Mission area: Cancer | European Commission (europa.eu)
- MSCA Actions | Marie Skłodowska-Curie Actions (europa.eu)
- SAMIRA Action Plan (europa.eu)
- TRANSCAN — ERA-LEARN (era-learn.eu)
- TRANSCAN-2 — ERA-LEARN (era-learn.eu)
- TRANSCAN-3 — ERA-LEARN (era-learn.eu)

# Annexes

# A. H2020 MSCA Cancer portfolio

| MSCA Action | Projects | Budget | Researchers |
|---|---|---|---|
| **H2020-MSCA-COFUND** | **9** | **€ 20.385.480,00** | **231** |
| H2020-MSCA-COFUND-2014 | 3 | € 7.795.680,00 | 92 |
| H2020-MSCA-COFUND-2016 | 2 | € 3.243.840,00 | 31 |
| H2020-MSCA-COFUND-2017 | 2 | € 5.069.520,00 | 54 |
| H2020-MSCA-COFUND-2018 | 2 | € 4.276.440,00 | 54 |
| **H2020-MSCA-IF** | **443** | **€ 83.046.552,76** | **443** |
| H2020-MSCA-IF-2014 | 60 | € 11.072.116,00 | 60 |
| H2020-MSCA-IF-2015 | 60 | € 11.020.776,60 | 60 |
| H2020-MSCA-IF-2016 | 71 | € 12.890.280,60 | 71 |
| H2020-MSCA-IF-2017 | 77 | € 14.155.461,00 | 77 |
| H2020-MSCA-IF-2018 | 90 | € 17.515.362,24 | 90 |
| H2020-MSCA-IF-2019 | 50 | € 9.593.827,20 | 50 |
| H2020-MSCA-IF-2020 | 35 | € 6.798.729,12 | 35 |
| **H2020-MSCA-ITN** | **100** | **€ 349.117.436,03** | **1350** |
| H2020-MSCA-ITN-2014 | 18 | € 59.711.655,62 | 232 |
| H2020-MSCA-ITN-2015 | 13 | € 46.032.931,01 | 189 |
| H2020-MSCA-ITN-2016 | 15 | € 45.654.350,74 | 181 |
| H2020-MSCA-ITN-2017 | 14 | € 48.196.896,48 | 189 |
| H2020-MSCA-ITN-2018 | 9 | € 30.185.140,86 | 113 |
| H2020-MSCA-ITN-2019 | 19 | € 72.583.360,20 | 271 |
| H2020-MSCA-ITN-2020 | 12 | € 46.753.101,12 | 175 |
| **H2020-MSCA-RISE** | **29** | **€ 28.467.500,00** | **1265** |
| H2020-MSCA-RISE-2014 | 5 | € 5.202.000,00 | 176 |
| H2020-MSCA-RISE-2015 | 4 | € 2.308.500,00 | 140 |
| H2020-MSCA-RISE-2016 | 4 | € 3.600.000,00 | 205 |
| H2020-MSCA-RISE-2017 | 4 | € 5.121.000,00 | 310 |

| | | | |
|---|---|---|---|
| H2020-MSCA-RISE-2018 | 3 | € 2.033.200,00 | 77 |
| H2020-MSCA-RISE-2019 | 3 | € 5.216.400,00 | 137 |
| H2020-MSCA-RISE-2020 | 6 | € 4.986.400,00 | 220 |
| **H2020-WF** | **6** | **€ 929.532,96** | **6** |
| H2020-WF-01-2018 | 1 | € 145.941,12 | 1 |
| H2020-WF-02-2019 | 4 | € 623.776,80 | 4 |
| H2020-WF-03-2020 | 1 | € 159.815,04 | 1 |
| **Grand Total** | **587** | **€ 481.946.501,75** | **3295** |

MSCA-COFUND 2019 call did not have projects on cancer; MSCA-COFUND 2020 call is not finalised at the time of drafting the report; WF - Widening Fellowships. A complete list of all H2020 MSCA Cancer portfolio is available at [MSCA Cluster event on cancer research and innovation (europa.eu)].

# B. Registrations

*Summary*

A **total of 860** participants registered for the Cancer Cluster event on 18-19 March 2021.

| **Total number of registered participants** | **860** |
|---|---|
| Countries represented | 52 |
| Continents represented | 5 |
| Speaker, Poster Presenter, Chair, Moderator, Panel Contributors | 106 |
| University and Research Institutes representatives | 514 |
| EU Institutions representatives | 140 |
| Participants with other affiliations | 206 |
| Researchers | 484 |
| EC officers | 114 |
| Policy makers | 6 |
| Participants with other functions | 256 |
| MSCA fellows and supervisors | 166 |

***Table 1*** *- Key numbers of registered participants to the MSCA Cancer Cluster event.*

## *Countries Represented by Registered Participants*

The majority of registered participants (59%) came from Belgium, Italy, Spain, UK and Germany (**Figure 1**). Five continents were represented: Africa, Asia, Europe, North America and South America.

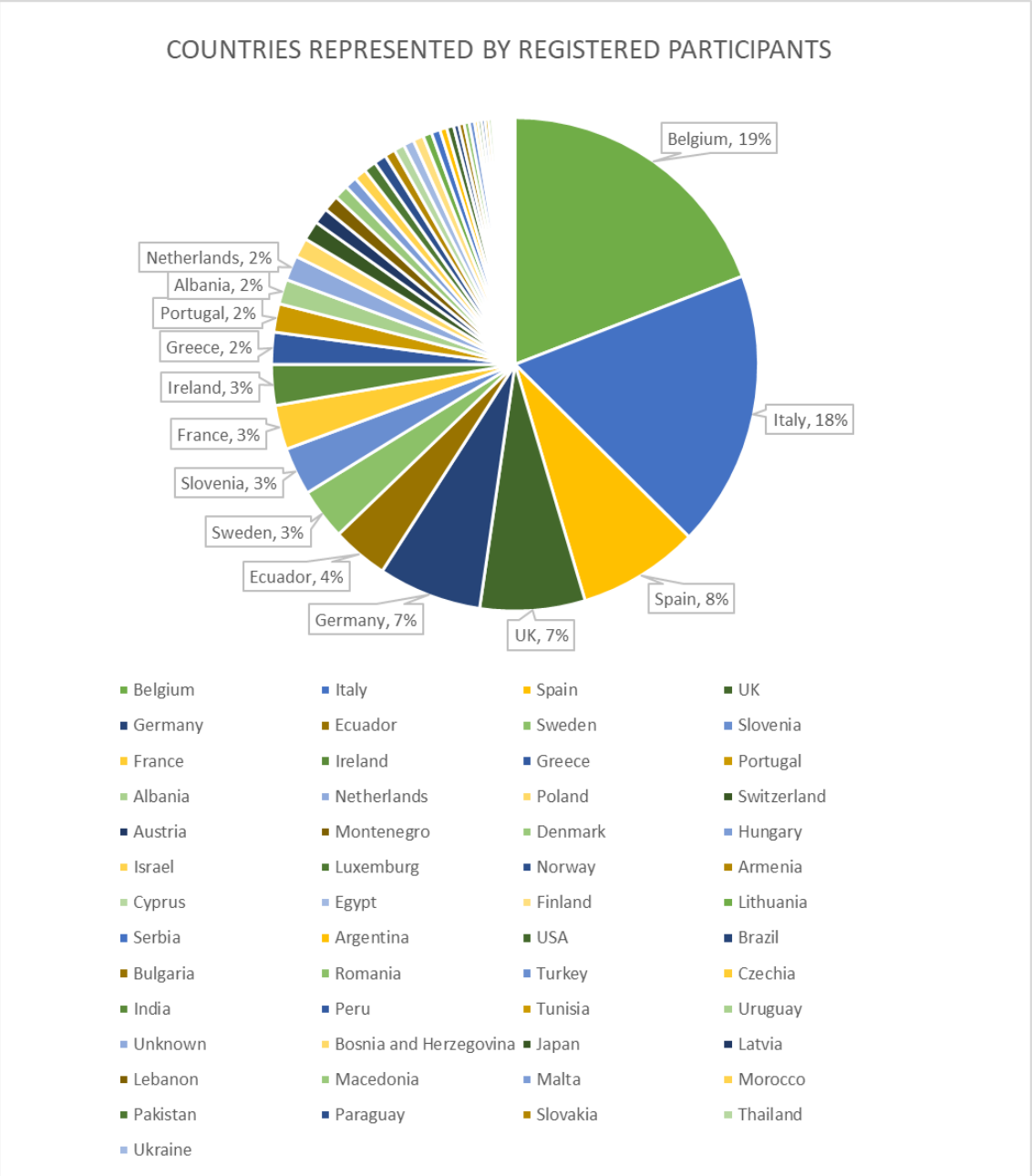



***Figure 1** – All countries represented by registered participants.*

## *Role in the Event of Registered Participants*

109 of registered participants were actively involved, either as a Speaker, Poster Presenter, Chair, Moderator, or Panel Contributor. They made up 13% of all registrations as seen in **Table 2**.

| ***Role in the event*** | ***Registered participants*** | ***%*** |
|---|---|---|
| *General audience* | 751 | 87 % |
| *Speaker, Poster Presenter, Chair, Moderator, Panel Contributor* | 109 | 13 % |

***Table 2** – Number and percentage of registered participants based on their role in the event.*

## *Affiliations of Registered Participants*

Most registered participants (60%) were affiliated to a University or a Research Institution. 16% were from EU institutions and 24% had other affiliations, as seen in **Figure 2**.



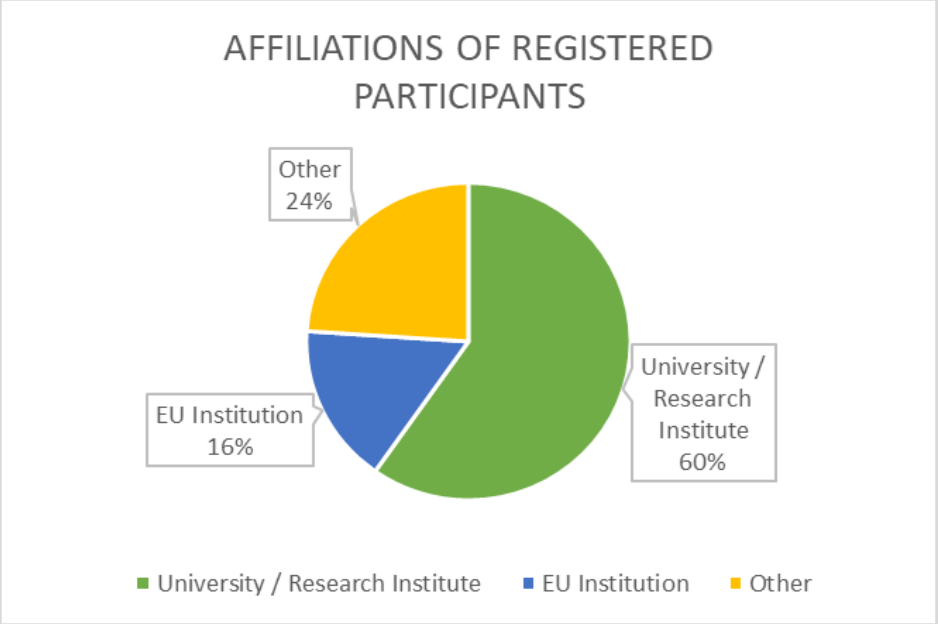



***Figure 2** - Distribution of registered participants based on their affiliations.*

Some examples of other organisations and companies that registered participants were affiliated to are shown in **Table 3**.

| ***Other affiliations*** | |
|---|---|
| World Health Organization (WHO) | Johnson & Johnson |
| ISERD, Israel Innovation Authority | Biogelx |
| Ministry of Education, Science, Culture and Sports of Montenegro | Dr. Borbala Schenk Consultancy |
| Istituto nazionale Tumori Fond. Pascale | Early Drug Development Group SAS |
| Saxon State Ministry for Science, Culture and Tourism | Jesús Usón Minimally Invasive Surgery Centre |
| Lombardy Life Sciences Cluster | Exiris |
| Outdoor against Cancer OAC Europe | Illumina Inc. |
| Canceropôle Provence-Alpes-Côte d'Azur | eGene |
| Boston Scientific | PEPTOMYC S.L |
| Agencia Uruguaya de Cooperación Internacional | Sixfold Bioscience |
| Funding Agency - Fondazione AIRC | Takis srl |

***Table 3*** *- Examples of affiliations of registered participants other than a university/research institute or an EU institution*

## *Registered Participants benefitting from the MSCA programme*

20% of all registered participants were either MSCA fellows or supervisors. There was 172 of them, as seen in **Table 4**.

| MSCA Fellow/Supervisor | Registered participants | % |
|---|---|---|
| no | 688 | 80% |
| yes | 172 | 20% |

***Table 4** - Number and percentage of registered participants that are MSCA fellows or supervisors compared to others*

## *Functions Held by Registered Participants*

Over half of all registered participants were researchers (56%).13% were EC officers and 1% policy makers (**Figure 3**).

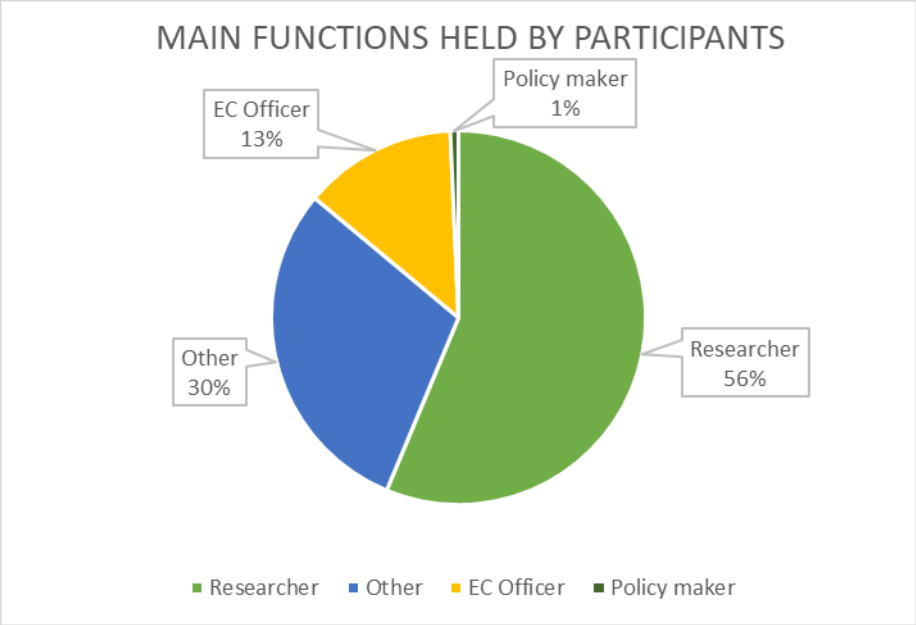



***Figure 3** - Distribution of registered participants based on the functions that they hold*

30% of registered participants held other functions such as students, professors, CEOs, directors, doctors, managers in pharmaceutical companies, administrative officers, NGO representatives and pharmacists (**Figure 4**).

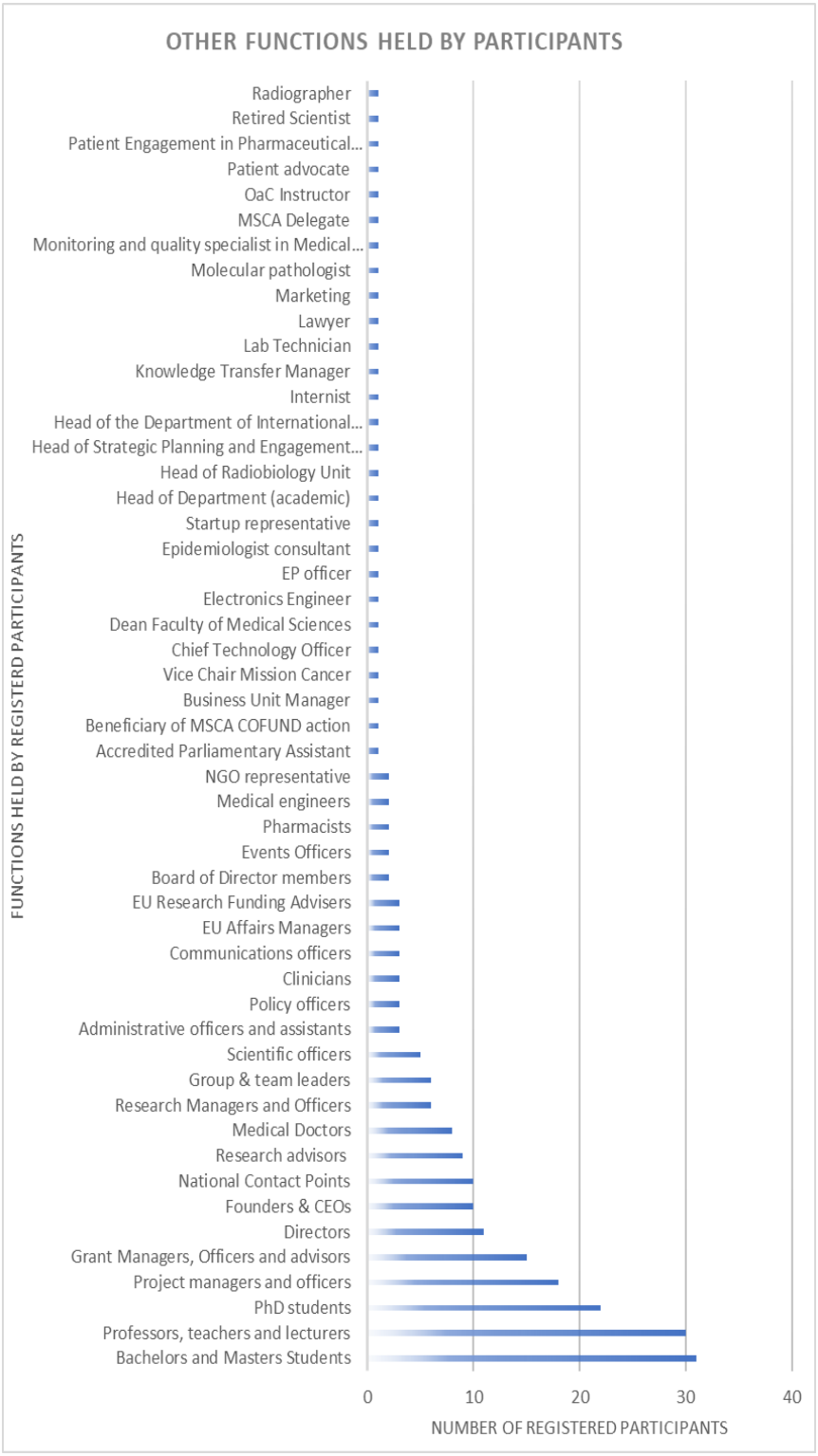



***Figure 4*** *– Variety of functions, other than researcher, policy maker and EC official, held by 30% of registered participants*

# C. Event participation

## *Attendance per panel*

**DAY 1**

- Opening Session: 312
- Panel 1: 242
- Panel 2: 251
- Panel 3: 223

**DAY 2**

- Panel 4: 186
- Panel 5: 127
- Panel 6: 139
- Closing Session: 110

Average attendance: 199 people

## *E-posters visits*

**3D virtual gallery visitors**

- March 16th: 26
- March 17th: 62
- March 18th: 131
- March 19th: 60

**Vimeo views**

- Panel 1: 503
- Panel 2: 332
- Panel 3: 252
- Panel 4: 58
- Panel 5: 51

## *E-poster votes*

**Total votes: 605**

- Panel 1: 544
- Panel 2: 106
- Panel 3: 34
- Panel 4: 10
- Panel 5: 14

## *Most voted e-poster*:

MAGNAMED - Novel magnetic nanostructures for medical applications (H2020-MSCA-RISE-2016; Grant No. 734801) - 393 votes

## *1 to 1 meetings for e-poster presenters*

- Panel 1 & 2: 4 meetings booked
- Panel 3,4 & 5: 3 meetings booked

# D. Slido report

slido

Event summary report
**MSCA Cluster Event on Cancer Research and Innovation**

| Active users 190 | | Questions 136 | | Poll votes 184 | |
|---|---|---|---|---|---|
| Engagement score | 592 | Likes / dislikes | 272 / 0 | Polls created | 4 |
| Engagement per user | 3.1 | Anonymous rate | 74% | Votes per poll | 46 |

## Popular questions

**Anonymous** 0 9
Where can one easily download full portfolio of EC funding of cancer and cancer-related project? For knowing what is funded and also to find new partners/collab

**Anonymous** 0 8
To Martin: As a coordinator of RISE project, what do you think should be improved in MSCA RISE scheme for the future?

**Richard Hall** 0 7
Question to Begona Arano: Majority of projects therapeutics and diagnostics - but surgery is an important aspects of many cancers. How can MSCA increase the funding for these projects.

**Anonymous** 0 7
Question for the panel: based on cancer patient libraries and what we have learned from immunotherapies, could a future "anti cancer" vaccine be realised or is this science fiction?

**Anonymous** 0 6
Question to John Ryan: How do you foresee collaborations amongst relevant DGs to successfully contribute to the Cancer Plan?

## Topics

projects therapeutics · specific research areas · mission approach · policy changes · business model · therapies · cd19 cart · cancer research · panel · keyeu citizens · future · **primary cancers** · results · anna · general · health · patient permission · msca · infectious disease · funding · industry · question · complementary approach · life · prevention · treatments

## Influential users

| | | | |
|---|---|---|---|
| R | Richard Hall | 2 | 7 |
| E | Edwin BREMER | 4 | 6 |
| E | Eliana RUGGIERO | 3 | 5 |
| M | Martin GOTTE | 2 | 5 |
| O | Oleksii RUKHLENKO | 1 | 5 |

*All Slido questions asked per panel (answered during the panel or archived for further consideration)*

| Question text | Labels | Status |
|---|---|---|
| Question C. Chomienne: I agree to mission approach. Question is how to keep these diverse stakeholders informed and working together moving results into action. | Opening Session | Archived |
| @Christine Chomienne: By which means can patient groups be integrated into the Mission concept, e.g. in RISE projects? | Opening Session | Archived |
| Question to Begona Arano: Majority of projects therapeutics and diagnostics - but surgery is an important aspect of many cancers. How can MSCA increase the funding for these projects? | Opening Session | Answered |
| Question to John Ryan: How do you foresee collaborations amongst relevant DGs to successfully contribute to the Cancer Plan? | Opening Session | Archived |
| The Cancer Mission aims to improve the life of EU citizens-What can be done to bring citizens closer to the heart of cancer R&I and include them in the mission? | Opening Session | Archived |
| Interdisciplinarity is key - What fields do you think should coordinate their efforts in order for cancer research to have an impact that is more significant? | Opening Session | Archived |
| How outcomes EU cancer strategy be applied broadly to general health system restructuring and capacity building of researchers and medics for all health issues | Opening Session | Archived |
| What evidence that ⬆funding leads to ⬆treatment chronic/infectious disease. Seems boosting Heath systems, increased awareness, prevention &early testing key | Opening Session | Archived |
| Q. for Cathrin BRISKEN: How can MSCA Programme contribute (in practice, specific action points) to tackle Cancer challenge in Africa/underdeveloped countries? | Opening Session | Archived |
| What would be the opportunities to feed the Beating Cancer Plan or in general the EU cancer policies with the results or experiences of MSCA research projects? | Opening Session | Archived |
| Reply on interdisciplinarity to fight cancer: Physics and medicine collaboration for diagnostics, new materials are key. Not just to keep in medical field. | Opening Session | Archived |
| In terms of translational research, what is the strategy of the MSCA? Who manages the business model of these new technologies after the projects? | Opening Session | Archived |
| Diet, smoke and alcohol are known to have major influences in cancer development. The public feeling is not one of urgency . How do we switch it back on? | Opening Session | Archived |
| To Georgi: The IAEA has been conducting programs related to using ionizing radiation in health. How is the current roadmap related to that and intends to use the findings. | 1 Diagnostic | Answered |
| To Martin: As a coordinator of RISE project, what do you think should be improved in MSCA RISE scheme for the future? | 1 Diagnostic | Archived |

| | | |
|---|---|---|
| Are there specific research areas where you feel priority should be given to further develop diagnostics of prostate cancer? | 1 Diagnostic | Archived |
| To the panel: How do you ensure exploitation of your research results by industry? | 1 Diagnostic | Answered |
| To Daniel: Clinical imaging data - are there major challenges to get patient permission for use of their image data for the mathematical models? Where is data shared? | 1 Diagnostic | Answered |
| To Zahra: Glycan structures: are these the most reliable (ie. most specific) biomarkers cancer? Does not seem unique enough for cancer cells; no other antigens to use? | 1 Diagnostic | Archived |
| Panel 1: what new skills will future doctors need to be able to use these new cancer detection technologies and treatments? | 1 Diagnostic | Answered |
| To Zahra: Given the STn is quite specific of cancer in humans, have you evaluated the detection in carcinoma tissues, and in circulating tumor cells that overexpress STn | 1 Diagnostic | Archived |
| Follow up question on exploitation of MSCA Projects; may you please share what are the best practices right now? Has there been a success story? | 1 Diagnostic | Archived |
| To all the researchers: do you think that you get sufficient training in IP or is your career mainly focused on publications? | 1 Diagnostic | Archived |
| How will the new biomarkers be adopted in the future for clinical use? What challenges do you foresee? How far/soon will it be from now 5 years, 10 years ++? | 1 Diagnostic | Answered |
| Any opinion about “non-conventional” techniques to detect biomarkers for very early stage cancer in biological fluids, i.e. NMR/ AI data interpretation? | 1 Diagnostic | Archived |
| What's next after being a Marie Curie Early Stage Researcher? How is knowledge managed and made sure there's sustainability after the project? | 1 Diagnostic | Archived |
| How can patients find out more about emerging therapies, and how can clinical investigators + industry access their feedback+ adapt trials accordingly? | 2 Drug/Therapy | Archived |
| Patients are often very well informed about novel therapies, etc. How can the perspective of patients be brought into the discussion of clinical trial design? | 2 Drug/Therapy | Archived |
| How can academic research in drug development establish stronger links to industry to ensure exploitation? In your opinion, does EU have a role to play in this? | 2 Drug/Therapy | Archived |
| For the Panel: Are there specific research areas where you feel more attention should be given to investigate novel therapies and push drug development further? | 2 Drug/Therapy | Archived |
| What are the ethical/legal issues using patient samples and how can policy changes help accelerate research in terms of increasing access to such samples? | 2 Drug/Therapy | Archived |
| For Nanasaheb: How does this approach compare to already in market targeted therapies for breast cancer treatment such as trastuzumab / aHer2? | 2 Drug/Therapy | Archived |
| There are > 4MSCA projects using magnetic nanoparticles for their research and innovation. How can EU help them to meet/collaborate together for HE programme? | 2 Drug/Therapy | Archived |

| | | |
|---|---|---|
| Panel 2: for rare cancers of unmet needs, how can their research be better exploited for other higher burden cancers (Eg. Technique sharing, training, etc...) | 2 Drug/Therapy | Archived |
| SYNTRAIN question: How can policy changes or research networks help overcome this block of drug testing going into phase 1 clinical trials (ie. only 5.1%)? | 2 Drug/Therapy | Archived |
| To Dr. Thorat. What is the penetration depth of infrared light into the human body? Is this the limit of photodynamic therapy? | 2 Drug/Therapy | Archived |
| Do you see an impact from the COVID-19 pandemic affecting the research in drug development from your perspective? | 2 Drug/Therapy | Archived |
| For Oleksii: Is you synergetic approach working only at high drug concentrations, as you showed, or it can work at much lower concentrations, thus less toxic | 2 Drug/Therapy | Archived |
| question for Oleksii: do you have data on the toxicity of the combined treatment | 2 Drug/Therapy | Archived |
| Which drug properties (conformational structure, dosage.. ) do you think that can better synergize for cancer therapy? How does your model provide those? | 2 Drug/Therapy | Archived |
| Who should be the initiator in making these collaborative links a success? What would be the key roles of each stakeholder? Is there a framework to guide these? | 2 Drug/Therapy | Archived |
| Ethics: what are patients' rights giving their tumor/cell material for research. Should they/their families get share of patent or any profits from industry? | 2 Drug/Therapy | Archived |
| Education/skills: should policy work to change our scientific education system to ensure next-generation scientists more familiar working with industry, clinics | 2 Drug/Therapy | Archived |
| How far is an intense use of organoids in clinical trial pre-phase? | 2 Drug/Therapy | Archived |
| Question for the panel: based on cancer patient libraries and what we have learned from immunotherapies, could a future "anti-cancer" vaccine be realised or is this science fiction? | 3 Immunotherapy | Answered |
| How do you ensure exploitation of your research results by industry? | 3 Immunotherapy | Archived |
| How can clinical investigators and/or industry access feedback from patient populations to adapt trials in immunotherapy accordingly? | 3 Immunotherapy | Answered |
| Question for Jana: Do you plan orthotopic models? These would be more relevant than subcutaneous models. | 3 Immunotherapy | Answered |
| Jana, Neurotoxicity is a well-known issue for CD19 CART. Have you evaluated potential brain toxicity with your GBM-targeted CART? | 3 Immunotherapy | Archived |
| Jana: Interesting talk, thank you! Did you optimize timing of application of treatment in your in-silico model? | 3 Immunotherapy | Answered |
| @all Immunotherapy achieves spectacular results in some tumor entities, while others are less responsive. How can this imbalance be improved? | 3 Immunotherapy | Answered |
| @Panel: is immunotherapy an approach where all EU citizens have equal access or is it only for "high income countries" & people priv insured? Policy solutions? | 3 Immunotherapy | Answered |
| Immunotherapy targets need to be protected to exploit IP, but how we ensure that all citizens benefit of the public funded research? Policy point of view | 3 Immunotherapy | Answered |

| | | |
|---|---|---|
| Have you maybe done a subanalysis in the various endometrial subtypes (like POLE and microsatellite instable disease)? | 3 Immunotherapy | Answered |
| Are your CD4 T cells stromally located? What do you think is their contribution? | 3 Immunotherapy | Answered |
| In the future, do you see a way to streamline the process to get it faster to the patients? | 3 Immunotherapy | Archived |
| CART in B-ALL associates with antigen-negative relapse. Is your engineered CART more effective at low antigen density (to prevent antigen-negative relapse)? | 3 Immunotherapy | Answered |
| Rubí, does your research suggest that CD3e could be used to replace or could be combined with CD3z? | 3 Immunotherapy | Answered |
| Do you think that patients treated in University Hospitals have more access to novel and experimental immunotherapy compared to those treated in "regular" hosp? | 3 Immunotherapy | Answered |
| Policy input: seems if DE and NL have this capacity CARt cells, then maybe policy contribution could focus on capacity building in other Eu countries. | 3 Immunotherapy | Answered |
| Primary cancers are a focus but metastases are a crucial element of cancer and are a leading cause of death in this cohort - how is this being addressed? | 4 Prevention/P.M. | Archived |
| For Josep: How easy to link dietary patterns (epidemiological studies) to levels of cancer incidence (how to control different factors that intervene in people's lives)? | 4 Prevention/P.M. | Answered |
| For Josep: Food intake is becoming more complex because of additives etc. how to avoid making a trip to the supermarket into a 5 hours visit of reading labels? | 4 Prevention/P.M. | Archived |
| To the panel discussion: How extensive is our knowledge of the human microbiome? | 4 Prevention/P.M. | Answered |
| To Josep: Could you provide some examples of foods/probiotics that could promote these metabolites? | 4 Prevention/P.M. | Answered |
| For Anna: Do you think it would be economically feasible/interesting to have a screening program for ovarian cancer just as there is one for cervical cancer? | 4 Prevention/P.M. | Answered |
| For Anna: Can immunotherapy be a good approach for certain ovarian cancers? All ovarian cancers? | 4 Prevention/P.M. | Archived |
| For Anna: Have you used predefined pathways for the cluster analysis of up/down regulated genes? | 4 Prevention/P.M. | Archived |
| For Anna: nice presentation! Did you have the chance to analyze also the ascites from ovarian cancer patients? | 4 Prevention/P.M. | Answered |
| For Anna: have you found any similarity between peripheral blood and tumor tissue? | 4 Prevention/P.M. | Answered |
| In your opinion, are metabolic changes consequence or cause of changes in cellular signalling? | 4 Prevention/P.M. | Answered |
| Did you look into how your data relates with other pathways like angiogenesis, inflammation, cell cycle genes...? Thanks! | 4 Prevention/P.M. | Answered |
| Can a metabolomic status that might be beneficial for AML be perhaps deleterious for other diseases? | 4 Prevention/P.M. | Archived |
| Great talk, metabolism is know to be altered between females and males in different cancers! Have you noticed any differences during your analysis? | 4 Prevention/P.M. | Answered |
| What are the obstacles to bring such research results into clinical practice? Anything policy can do? | 4 Prevention/P.M. | Archived |

| | | |
|---|---|---|
| Can outdoor + activities in general improve psychological burden in cancer patients? If so how could one envisage making it accessible to less well-off patients? | 4 Prevention/P.M. | Answered |
| Have you liaised with those who may be trying to do something similar for other diseases such as dementia, Alzheimer's? Should you lobby policy makers together? | 4 Prevention/P.M. | Answered |
| Fantastic presentation on importance of the outdoor activities for fighting against cancer, and benefits for health in general. To be shared widely. | 4 Prevention/P.M. | Answered |
| Some studies hint jogging at the wrong time of the day in the wrong place (pollution) can play a negative role in cancer in the long term. | 4 Prevention/P.M. | Archived |
| Such Physical Activities are not part of the Palliative Therapies. Shall be understood that it could be included as well? | 4 Prevention/P.M. | Answered |
| Great initiative, Petra! I wonder how do you engage patients. Particularly during chemotherapy patients often (or not?) feels weak and demotivated. | 4 Prevention/P.M. | Archived |
| Is public health finally changing and considering a more holistic approach? Including more people under different economic conditions and emphasis on prevention | 4 Prevention/P.M. | Answered |
| I missed the presentation, where can I find it? Is there possible to contact Ms Thaller, thank you, | 4 Prevention/P.M. | Archived |
| Such interesting discussion!! Perhaps a good point to reflect: practical ways to promote studies on how the "holistic approach" affects mol Biol of cancers. | 4 Prevention/P.M. | Answered |
| Do you monitor your research subjects afterwards? Do you evaluate their mental status? To look for improvements? | 5 Quality of life | Answered |
| How to change the mind-set of some patients from wanting to survive disease to focusing more on their quality of life as well as part of successful treatment? | 5 Quality of life | Answered |
| Have you involved discussion groups (e.g. churches or other established institutions) in your approach? If people are opening up about their condition for example. Feasible? | 5 Quality of life | Answered |
| Not everyone will reach out to charities. Some people will hide their condition and only open up in places where they go regularly before getting ill. | 5 Quality of life | Answered |
| For the panel discussion: Agree about patients getting lost in medical system after “cure”. Can we have EU lifelong support/healing systems “cancer coaches” to guide patients over time? | 5 Quality of life | Answered |
| For the panel discussion: Do we need more research in secondary or tertiary effect of cancer treatments (Eg. Effects on nerve systems from chemotherapy)? How to monitor >10 yrs? | 5 Quality of life | Answered |
| Have you ever used twins in your studies? Do you know of any study that has? Probably very difficult to find subjects... | 5 Quality of life | Answered |
| For the panel discussion: How to take fear/taboo out of having cancer? Can we empower survivors? How to support mental health & minimize stigma + same time help new patients fight cancer? | 5 Quality of life | Answered |
| What are best approach critical stages of supporting patients with cancer: (1) giving cancer diagnosis (2) post-cure mental health (fear and avoidance doctors)? | 5 Quality of life | Answered |
| Are certain cancers becoming a chronic disease? Living with cancer becomes the norm for most cancers. | 5 Quality of life | Answered |

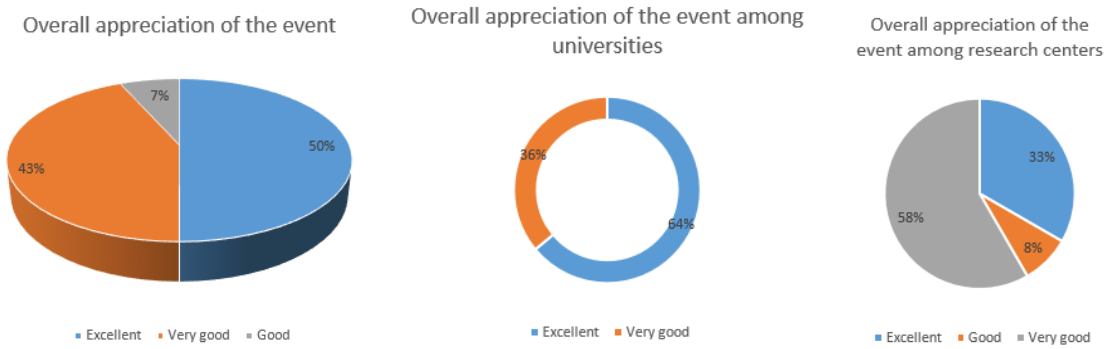
| | | |
|---|---|---|
| Good point of cancer as “chronic disease” and therefore health insurance needs to take this into account in authorising regular testing and treatments. | 5 Quality of life | Archived |
| What can policy do to protect cancer patients from discrimination from health insurance companies? | 5 Quality of life | Answered |
| Do you believe all research related to quality of life of cancer patients and survivors is actually reaching healthcare settings and patients and citizens? | 5 Quality of life | Answered |
| Can you share some of the lessons (barriers or opportunities) you have learned in your work to improve the quality of life of cancer patients and survivors? | 5 Quality of life | Answered |
| Would you have any suggestions on what methods could be used to gaining a comprehensive understanding of the holistic needs of subgroups exposed to cancer? | 5 Quality of life | Answered |
| How would you communicate the issue of secondary and tertiary prevention in Europe? And the importance of complementary therapy? | 5 Quality of life | Answered |
| How do these political plans become funding opportunities? | 6 Policy/Other | Answered |
| How to avoid "double funding" (same projects) and synergise under Mission Cancer, Beating Cancer strategies and various DG/programmes DGEAC,R&I, SANTE, ERC, etc. | 6 Policy/Other | Answered |
| Where can one easily download full portfolio of EC funding of cancer and cancer-related project? For knowing what is funded and also to find new partners/collab | 6 Policy/Other | Archived |
| Where did the target saving 3million lives come from for Mission Cancer? Is this really the right target? Or should it be more about number of persons screened? | 6 Policy/Other | Archived |
| How to capitalise "knock on" effects of Beating Cancer strategy on urgent capacity building health systems across Europe for other chronic/infectious diseases? | 6 Policy/Other | Archived |
| How to rationalise with EU citizens energy + funding EUCancer plan & Mission in middle of pandemic crisis? How can the Cancer mission be retailored for COVID? | 6 Policy/Other | Answered |
| The EuBeatingCancer "newsletter" is a super idea to maintain sharing of information + synergies. How will newsletter be promoted? Can EU citizens contribute? | 6 Policy/Other | Archived |
| How can we encourage more "youth engagement" from DGEAC sport, youth, education? Can EU come up with a video game better than Fortnite that helps "beat cancer"? | 6 Policy/Other | Answered |
| There are international world cancer days...Will the EU make their own "Beat Cancer Day"? | 6 Policy/Other | Answered |
| Sport: Many non-EU countries measure of "minimal cardio" level in schools and actions taken if you fail. Don’t we need this in Europe & incentives for youth? | 6 Policy/Other | Archived |
| What are the specific opportunities for PhD and postdocs under the Erasmus + program? Are they bottom up? Related to specific Alliances? | 6 Policy/Other | Archived |
| Is there any potential European Partnership besides IMI that will be relevant to R&I in the field of health/cancer? | 6 Policy/Other | Archived |
| Does Horizon Europe plan to implement any re-integration program for ex-fellows? | 6 Policy/Other | Archived |

| | | |
|---|---|---|
| How will personalised medicine be priced and what will be the formula to know its value? | 6 Policy/Other | Archived |
| EIT Health - What activities/programmes of EIT Health are opened to entities that are not members of this partnership? Many actions are just for members.... | 6 Policy/Other | Archived |
| Idea: If you want youth to take up cancer prevention and citizen engagement then we need a "Greta Thunberg" of Cancer movement. Schools to fight cancer | 6 Policy/Other | Archived |
| What are the thoughts of the panel on vaccination against cancer? Do you think this a future research opportunity? | 6 Policy/Other | Answered |

# E. EU Survey

The EU Survey post event showed that the event was very well perceived, as 50% of the contributors to the survey considered the event as excellent, 43% as very good and 7% as good.

The event received excellent appreciation among the participants coming from Universities, as 64% of them considered the event as excellent. Whereas the majority of the representatives from research centres considered the event very good.



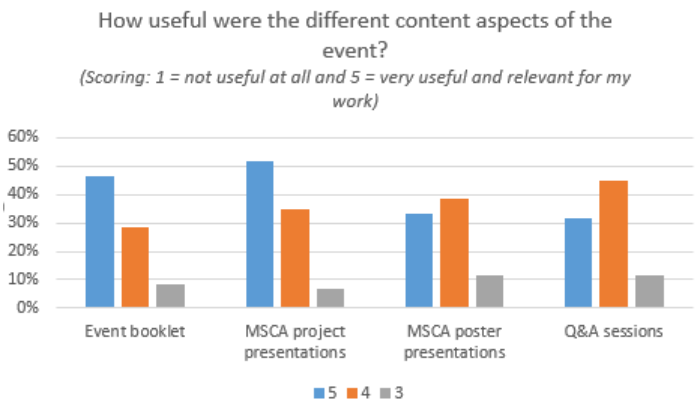

The participants appreciated the clear structure of the event, valued the diverse aspects involved in the cancer cluster, from diagnostics to the quality of life, they considered the event very interesting with innovative discussions on topics of high interest for the public.

The participants considered also useful the fact that the event provided a good overview of MSCA programs in terms of what types of calls are available. Moreover, the contributors to the survey remarked that the speakers were very good and that their presentations were very interesting.



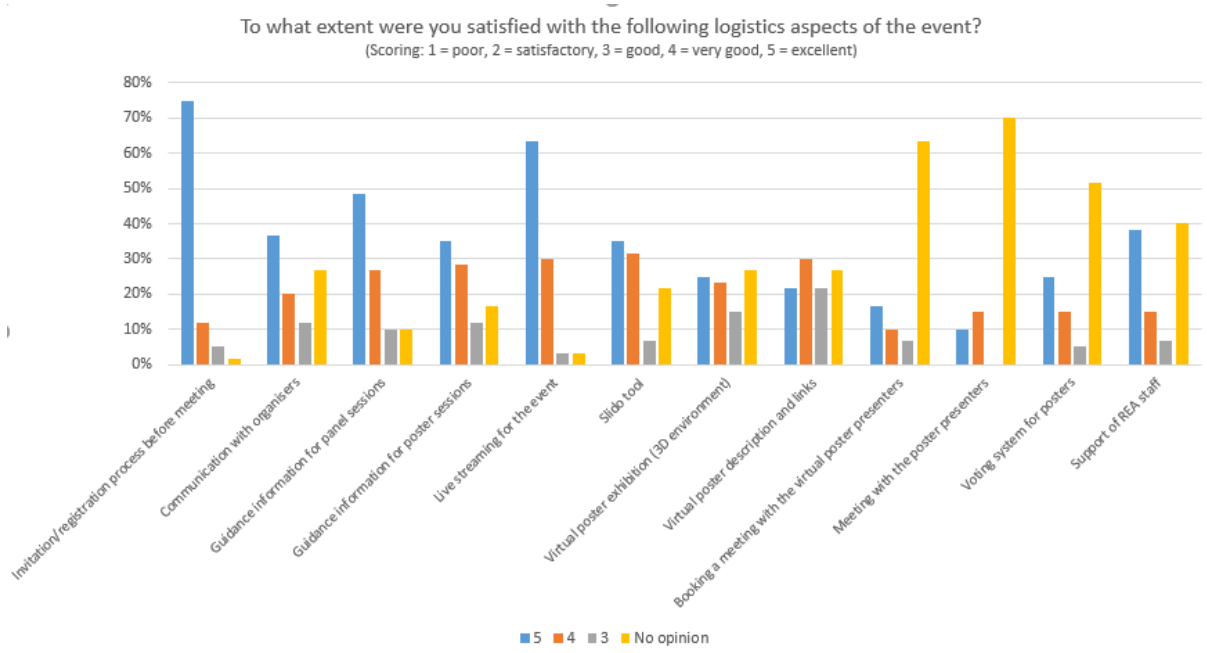
## *How useful were the different content aspects of the event?*

The participants provided insights on how useful were for them the various content aspects of the event. The event booklet and the presentations of projects were most appreciated. Nevertheless the poster presentations and Q&A sessions received high appreciations as well, as you can see in the below chart.



## *To what extent were you satisfied with the following logistics aspects of the event?*

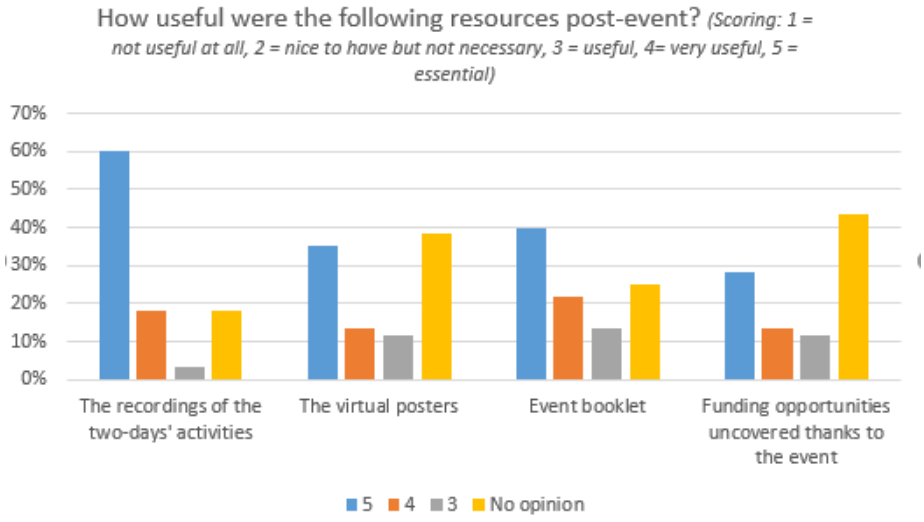
From the below chart it can be easily seen that the live streaming of the event was highly appreciated which gives us reason to consider that live streaming should be considered in future events. Moreover, we are happy to notice that the registration process before the event went extremely well.




## *How useful were the following resources post-event?*

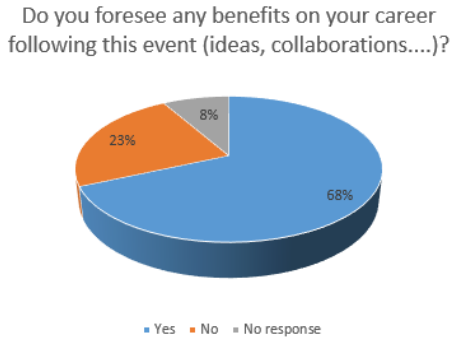
The recordings of the two days activities are by far the most useful resources post event for the participants.



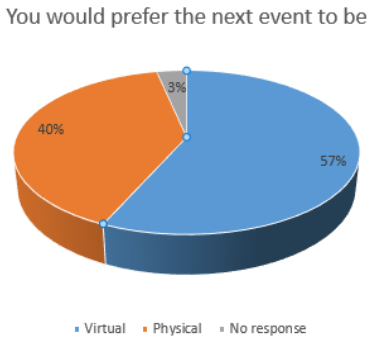


*Do you foresee any benefits on your career following this event (ideas, collaborations....)?*

A large majority of the participants to the survey, i.e. 68%, considered that the event would bring benefits on their career. From the feedback on this question, some participants to the survey confirmed that they contacted presenters in order to establish new collaborations, some got ideas on how to organise a similar event. In general, the participants to the survey had a favourable assessment for this event in terms of their career pursuits.




The answer to the question concerning the participants' preference for future events was in favour of virtual events.




*What have you taken away from the event? Did it offer possibility of establishing new work related collaborations?*



At this question some of the answers received were:

- A very interesting experience, update about current interests in the field, interesting Q&A. Feedback in a modern and interesting manner.
- Collaborations and perspectives
- the event provided very valuable information that can be used for the organisation of future similar events, such as set-up, organisation, etc.
- ideas to develop within my research group
- informal networking cannot be replaced by virtual event! But a virtual event offers the opportunity to visit "less" important events
- inspiration for collaborations
- It gave me direction for where possible funding could be targeted.
- More awareness of all the funding already done and what needs to be done still

*What are the fields to be further explored in terms of research and innovation, education and training? Are there any gaps you would have identified?*

Some of the ideas provided by the participants to the survey are:

- Bioinformatics
- Create more possibilities for research/training to continue after the end of the EU funding
- Molecular Virology, Clinical Applications, Vaccine development
- Biochemical - and Image Biomarkers. Meaning and Applications
- Environmental factors in cancer occurrence (e.g. chemical contaminants) or prevention (e.g. diet/lifestyle)
- Erasmus for Research Centres
- communication between scientists and industries should be encouraged/promoted
- quality of life after treatment
- Surveillance of long term health effects for cancer patients
- The field to explore is the transition between basic research with clinical research
- Vaccines
- The topics of personalized medicine and quality of life of patient and survivors should be given more importance in events involving researchers and policy makers, and representatives of the community should also be involved.

*How can project findings be better communicated to policy makers?*



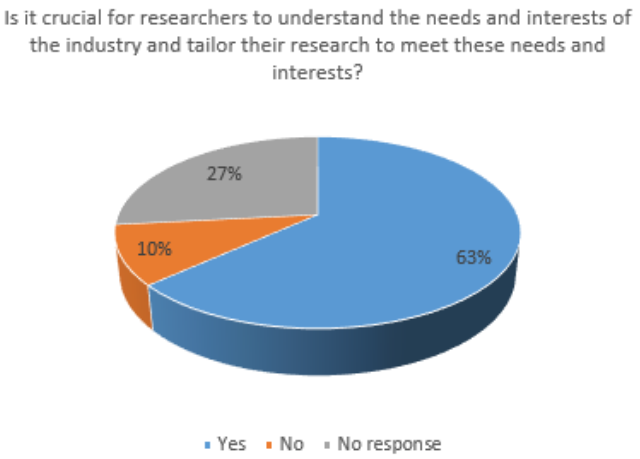
In terms of better communication towards policy makers, we received a few ideas:

- Create a direct intersection between policy makers and researchers, explain better to researchers how to convey their messages to policy makers and train policy makers to ask the right questions for obtaining valuable policy feedback from researchers.
- Creating a simple internet link to MC awards where the applicant can simply add a short paragraph of own achievements and publication record (MEDLINE RECORD) for example
    - Invitation of policy makers to scientific/clinical meetings
    - Online / web access to dissemination actions. Links on ec.europa
    - e-mail to stakeholders to provide feedback
- Involving policy makers at the earliest point in the project lifecycle so that they are aware of the work.

- Meetings in which all interested parts should be invited.
- portfolio approach of research projects should help to network between projects and stakeholders
- That is the 1 Million question... unfortunately very hard to answer. During the event, I could see that the "issue" has been truly identified now. We (the scientists) know that communicating outcomes and needs to policy makers is key, but we do not really know where to start. Perhaps EC/REA could further facilitate the dialogue, by organising events like this, training and dedicating staff to support that communication ...
- This event was a good way to communicate the results, but perhaps it is necessary to hold a special event where political actors participate directly and commitments are established.
- With support and concerted interactions, initiated and supported by funders.

## *Is it crucial for researchers to understand the needs and interests of the industry and tailor their research to meet these needs and interests?*

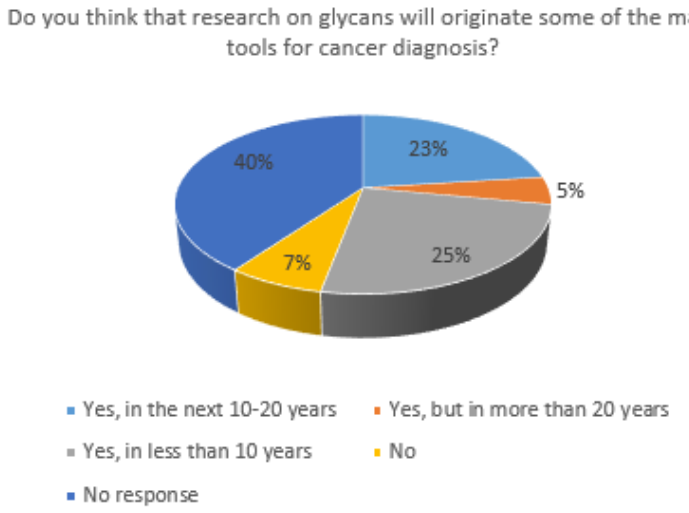
Most of the participants to the survey, i.e. 63%, considered that it is important that the researchers understand the needs and interests of the industry and therefore conduct their research so that to meet these needs and interests.



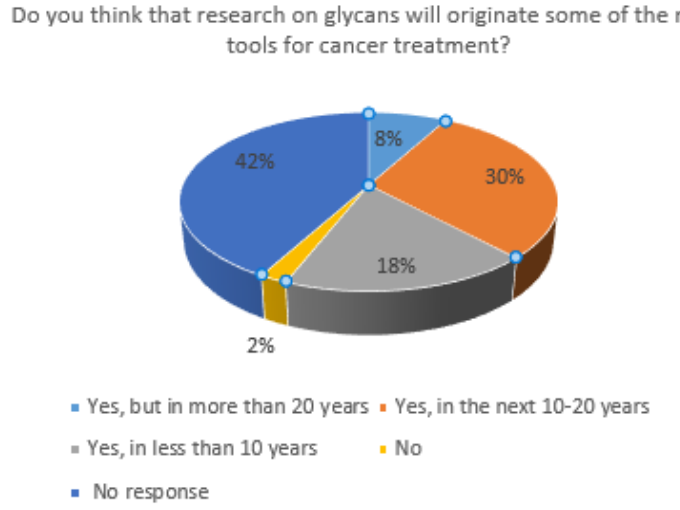

However, we received some additional comments showing that not everything has to be oriented to industry as basic research independent from industrial interests is key to advance knowledge and is the basis for developing new industrial interests and applications. Furthermore, it is important to understand changing societal requirements and behaviours to target the right populations and to have 'blue sky' research in order to have research that is beneficial to society not just industry. In addition, one feedback pointed out that it is crucial for the researchers to understand the needs of the patients.

## Panel 1 Diagnostics support to clinicians

*Do you think that research on glycans will originate some of the main tools for cancer diagnosis?*




*Do you think that research on glycans will originate some of the main tools for cancer treatment?*



## Panel 2 Drug development and therapy

### *How can EU policies be improved/modified to tackle the observed hurdles in the different phases of Clinical trials?*

For the improvement of the EU policies with the purpose to tackle the different phases of the Clinical trials the participants to the survey answered:

- Better control of the quality of clinical trials.
- Communication events, such as this one.
- Coordinated access to: public funding at different phases, or private-public partnership, access to volunteers from all over Europe
- EU policies should be made with open mind and be less rigid.
- It is important to maintain the reliability of the Clinical Trials (as trust is easy to lose when steps are skipped) but to ensure that all avoidable delays (in particular the administrative ones) are detected and reduced.
- Using globalized rules
- more visibility, public access and providing blinded data from clinical studies to public

### *In your view, what scientific areas will be at the forefront of drug development/design in the coming years?*

For the scientific areas that should be important for drug development the participants to the survey responded:

- Computational Drug-Discovery, Nanomedicine, Personalised medicine (tailor cut treatments for each patient), use of technologies adopted to fight against Covid-19 for other areas (mRNA, vaccines, etc.).
- I believe that the repositioning of drugs is an area that has been revalued with the pandemic, adding the knowledge contributed by the projects presented, it is a good opportunity to start these types of studies.
- Repurposing drugs.
- Extracellular matrix, extracellular tumour microenvironment.
- Therapy by using small RNAs



### *Do you think that the involvement of Industry in the early stages of Drug development research is missing?*

For the involvement of industry in the early stage of drug development, the participants to the survey responded:

- Absolutely. In current scenario and economic system, they cannot afford investing time and money so early before research can be actually translated into a marketable product. Then there is the issue with costs,

time and efforts for patenting...that academic researchers can usually not afford... And industry would never have any interest on a novel drug that hasn't been protected.
- More collaboration between the academic sector and the industry, as already supported, would give the flexibility of the first steps and ensure that promising drugs can be produced and tested without excessive delays.
- No, this should be research based. The early stage of drug development must be managed by public research institutions supported by governmental grants.

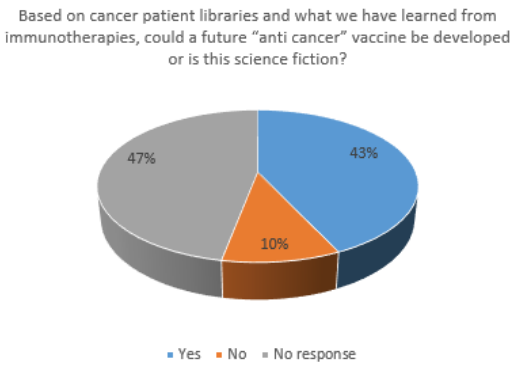
*One of the recommendation from the event was to further encourage the involvement of Industry. How would you envisage it in the context of your research on Drug Development?*

Concerning the further involvement of industry for research on drug development, the participants to the survey responded:

- Although this is not directly applicable for me, I would suggest that the scientists should include/involve industries in the early part of a project or even during the design of experiments/projects.
- Co-financing and providing od manufacturing capabilities+ logistics
- If there is an open call instead that one with fixed dates. The process is too long for industry. The call launched in MARCH, the Evaluation process in Sep-Dec, and the contract Within next winter Spring. It is really not attractive for Industries.
- To support transfer of knowledge from the industry to the academia via short-term visit exchanges.
- Very beneficial. If the Commission could help to offer more attractive "conditions" for industry partners to collaborate in drug development projects.

## Panel 3 Immunotherapy

*Based on cancer patient libraries and what we have learned from immunotherapies, could a future "anti cancer" vaccine be developed or is this science fiction?*




A large majority of the participants to the survey who provided a response to this question considered that a vaccine could be developed in the future. However, from the additional comments received to this question while some supported the development of vaccines others considered that focus should be on development of drugs as opposed to vaccines. At the same time, the politics of the life style and their influence on the probability of cancer occurrence including preventive measures should be more explored. Moreover, one contributor stated that the immune mechanisms of evasion do not allow the development of vaccines in cancer. However, such investigations could allow researchers to get adequate immunotherapies different to the vaccine concept, as a preventive method.

*How can clinical investigators and/or the industry access feedback from patient populations to adapt trials in immunotherapy accordingly?*

Concerning the feedback from patients, the participants to the survey responded:

- A European database should be created that is accessible to all parts interested.
- By organizing large communication and dissemination events presented by experts in scientific communication (who are not easy to find).
- Data platforms or exchange with researchers (agreement, joint undertakings)
- Engage directly and transparently with patient populations, their careers and families or consider community engagement approaches.
- Through patient organisations/alliances or representatives.



*Do you think that patients treated in University Hospitals have more access to novel and experimental immunotherapy compared to those treated in "regular" hospitals?*

Most contributors agreed that patients treated in University Hospitals might have more access to novel treatment, although it was also an opinion suggesting that this depends on the medical staff involved. Please find below the replies.

- Certainly, the outcomes from those treated in University hospitals or hospitals with cancer centres appear to be better than those treated in 'regular' hospitals. The likelihood is if the hospital is a cancer 'active' hospital where trials are taking place then patients attending those hospitals will be informed and have easier access which may influence their participation /access to experimental trials, if they are a suitable 'fit' for the trial.
- Not really depends from medical staff involved.
- Probably, but it depends on the institution (University hospitals vs regular hospitals) and by the skills and degrees of willingness to address the problem of the managers of these different institutions.

## Panel 4 Prevention and Personalized medicine

*What kinds of prevention strategies do you think are the most promising to reduce the burden of cancer in the EU population in the 10 coming years? For which other health issue(s) should prevention strategies or measures be developed in priority?*

Most of the contributions to this question emphasized the importance of early diagnosis, healthy food and life style, exercise as prevention strategies as you can see below.

- Early diagnosis, Increasing the awareness of the efficacy of vaccination against infectious agents causing cancer, Better availability of screening procedures for drug repurposing . Organoid models.
- Exercise, Healthy Food and Habits campaigns. Also anti-smoke campaigns as well as l as quit smoke support. Cancer is number 1 priority followed by Cardiovascular and Neurodegenerative/ age-related diseases.
- Healthy and sensible lifestyle with plenty of vegetables and fruits in the diet as well as the regular exercise could reduce the burden of cancer in the EU and around the World.
- Healthy foods and sports. several main health issues will also benefit from these prevention strategies, e.g. cardiovascular diseases, diabetes, obesity, stroke, mental illness ...
- Nutrition and lifestyle (physical exercise, no smoking, etc.)
- Prophylactic, increased access to diagnostics for also younger population, genetic tests.
- Wide screening of population using highly sensitive techniques.
- The quality of life focus on natural products and healthy life style.

*What are the main barriers you foresee for the development of Personalised Medicine in the EU health systems? What would facilitate this development? For which health issues do you think Personalised Medicine would be easier to put into practice?*

The answers received for these questions are listed below and they range from lack of resources, costs for health system or to put in place the personalised medicine to the ethical aspects linked to personal data and sharing biological data.

- Lack of resources.
- Cost for individuals/EU health system. More research in specific areas might help to some extent to facilitate this development.
- Ethical aspects (GDPR) could be a barrier. Also economic associated burden, together with deterioration of public health systems across EU (and increasing privatisation of medicine). Wealthier people will for sure have more probabilities to access Personalised medicine.
- Cost to install personalised medicine, burden to health system while this will take place at the same moment of demographic change ( much older people - neurodegenerative diseases).
- Insufficient funding, time, personnel
- One of the barrier is represented by a misinterpreted concept of privacy and sharing biological data.
- Screening patients for drug availability even in case they are not approved for that specific cancer.
- The resistance of the clinician and medical staff, as it will be a major change of their work practice. The resistance of the administrative staff of the medical systems and eventually of the policy makers and politicians. To facilitate its development it is very important to involve the public and to educate the public in health, health issues and health issues prevention. All health issues would benefit from this involvement and education of the population.
- This needs metadata received from many individuals so all ethics aspects are important.



*How can the perspective of patients be brought into the discussion of clinical trial design?*

For patients involvement in clinical trials design the below answers highlight the fact that patients should be involved through various activities, better communication, use of studies on patient experience or research groups involving patients through regular discussions, involving patients through interviews, questionnaires, platforms to exchange experiences.

- As above, by organizing large communication and dissemination events presented by experts in scientific communication (who are not easy to find).
- I believe that the public need to be informed firstly of the role of clinical trials more generally rather than wait until they become a patient. Specifically engaging patients for clinical trial design discussions can be achieved by engaging with charity.
- Involvement of patients though interviews, questionnaires, platform for experience exchange, representative patient's organisations at different levels of governance.
- More transparency should be ensure on clinical design.
- Perhaps to start sitting them together with all the other actors playing a role in clinical trials and discuss?
- Research groups should involve perspective patients in regular discussions and feedback sessions.
- Taking into account studies on patient experience when designing clinical trials.
- The necessity to include patient organisations into the project. This should however not be done by requesting them as partner, but more like the "open access policy" or midterm review meetings. Eg. Necessary to plan for instance 2 stakeholder meetings with patient organisation and to include budget for that in the project (make sure that budget is available for the travel of members of patient organisation).

## Panel 5 Quality of life of patients and survivors

*Are there knowledge or policy gaps that, if filled, can join the dots in our quest to reduce the burden of cancer in the EU?*



From the below contributions received on the policy gaps which needs to be filled we can identify the need to involve patients and improve communication between patients and medical staff and in general the need to focus on quality of life of patients.

- Access to diagnostics, knowledge, treatment.
- Gap in funding at national level across countries.
- I think we need to understand better patients' long-term effects from treatment side effects and co-morbidities and their social environment to work towards their prevention. The poorest outcomes accrue systematically to the most disadvantaged yet many life-style interventions inadvertently increase inequalities. The social environment provides external drivers that shape behaviour, cognitive functioning and decision-making. Considering 'upstream' policy interventions alongside public health interventions and

how they impact directly on different social group could help bridge some of these gaps.
- It is very important to involve the voluntary patients/public in the intervention/strategies to reduce the burden of cancer. More communication should be established between the medical staff and the patients.
- More focus on the QoL of the patients.
- Not enough measures to advertise healthy life style.
- Not too much is about life style, the avoiding of cancerogen etc.

*Do you think that all excellent research related to the quality of life of cancer patients and survivors is successfully reaching our healthcare settings and patients? If not, do you have any ideas on how to improve this situation?*

From the below answers received from participants to the survey it seems that the research done on the quality of life of cancer patients is not reaching the healthcare and patients.

- I think some but not all of QoL research is reaching patients. I think we recognise that barriers around implementation exist and there is a need to identify resolutions to improve this. I don't believe a one size fits all approach to implementation across all countries is possible as healthcare settings differ but rather we need to identify the barriers in individual settings and collaborate to resolve them. Countries can learn from each other. Undertaking impact assessments and evaluations showing the benefits in the short, medium and long term may help policymakers and service providers in their evaluations. This will require some form of qualitative assessments with a wide range of users not just those that are normatively willing to engage. I think the key is collaboration. Basic scientist would for example benefit from collaboration with social scientists to help support implementation of interventions.
- No, quality of life is an important issue, however it must be considered that might have less importance in life threatening situation than not in less difficult situations.
- No, different political priorities and lack of sort of conditionality to access e.g. EU funding for national authorities, competition in the academic environment that may have influence on priorities' setting.
- No, I do not think that all outcomes from research regarding the quality of life of cancer patients and survivors reaches the patients and healthcare settings.
- No, it is time, for all but particularly for medical staff, to see that behind the cancer/health issue there is an individual whose feeling during the

health issue can largely influence the outcome. Medical staff should be trained to take this more into account.

### *Do you have any proposals or suggestions for the European Commission to improve the Quality of Life of Cancer Patients and Survivors?*

From the contributions received, which are listed below, we can see that many of them are suggesting more funding for research on quality of life of cancer patients and survivors.

- Important also to prioritise research into QoL and pain.
- Integration of implementation of science and knowledge translation with the field of policy implementation research have evolved somewhat independently, contributing to a disconnect that may impede uptake of innovations. Additionally, there remains in many areas a disconnect between scientific 'break-through' and societal benefits and a gap between policy and public health interventions that have potential to increase health disparities. My proposal to the Commission would be to support mechanisms/research to address these areas. To continue to promote citizen engagement but to ensure that the engagement is reflective of all communities particularly those in lower socio-economic strata as these populations are known to have poorer quality of life.
- Medical staff should be trained to take the feelings of patients more into account. And, all debates on a health issue should have a discussion on the quality of life and prevention of the people affected or at risk (with active involvement of these people).
- Nothing specific, apart from suggesting EC to fund as many projects in this area as possible...
- Programmes, projects on improvement of patients and survivors well-being, good access to rehabilitation, facilitation of return to labour market when necessary, increased number of training/ education for medical personnel, access to necessary information.
- Put money into Calls focusing on the equality of life for cancer patients and survivors.
- So more than evaluations of QOL through questionnaires it could be important to evaluate the effect of diet, exercise and changing of work. And also harmonize measures within an European framework to reduce distances between social measures with regard to really late stage cancers patients taken by different countries.

# F. Programme

## DAY 1 - Thursday 18 March

| 9:00 - 10:20 | Opening Session | |
|---|---|---|
| 09:00 - 09:05  | **Jean-Bernard VEYRET** (European Research Executive Agency) | Chair and Moderator<br>*Head of Unit A2, MSCA Individual Fellowships: European* |
| 09:05 - 09:10  | **Marc TACHELET** (European Research Executive Agency) | Welcome<br>*Director* |
| 09:10 - 09:20  | **Begoña ARANO** (European Research Executive Agency) | Cancer research in Marie Skłodowska-Curie Actions<br>*Head of Department A - Excellent Science* |
| 09:20 - 09:35  | **John RYAN** (Directorate-General for Health and Food Safety) | Presentation of Europe's Beating Cancer Plan<br>*John F. Ryan is Director of the Commission Public Health directorate since September 2016.*<br>*Previously, in the same department, he was the Head of Unit responsible for a number of public health policy areas (cancer, drugs, promotion, monitoring, infectious diseases). He was a Commission representative on the Board of the EU Lisbon Drugs Agency, and is currently the Commission representative on the Board of the European Centre for Disease Prevention and Control. He also had the charge of dealing with tobacco control issues. Current priorities include the development of an EU cancer plan, antimicrobial* |

*resistance, vaccination policies, and the negotiation of financial instruments to support health, including research. He has previously worked on the completion of the internal market, and on international trade negotiations. He is also an official of the Irish civil service (on leave). He is a fellow of the UK faculty of public health.*

09:35 - 09:50 **Christine CHOMIENNE** (Université de Paris)

Presentation of EU Cancer Mission

*Christine Chomienne is Professor of Cellular Biology at the Université de Paris, France*
*She is currently Vice-Chair of the Mission Board Cancer at the European Commission. She was Director of Research and Innovation at the French National Cancer Institute (INCa) and Director of the Cancer Institute of France Research Organisations (Inserm & AVIESAN). She is past president of the European Hematology Association. She qualified in medicine at the Université Paris Diderot and received certification for specialized training in Hematology in 1983. She obtained her PhD in 1989. Dr. Chomienne has served on many scientific and clinical committees in France and Europe in Leukemia, Immunology, Oncology and Stem Cell Research. She was head of the Cell Biology Department at the Hôpital Saint Louis, Paris and Director of the University Inserm Research Laboratory at the Institut Universitaire d'Hématologie for the last 25 years. She is committed to education nationally and coordinator of different Courses and Masters at the University Paris Diderot. She established the Institute of PhD Schools at the University Paris Diderot (23 PhD of all disciplines) and coordinated an ITN Marie Curie FP7 on Cancer Stem Cells. She has recently been involved in patient/parent participation in cancer research and in communication, education on personalized medecine. Dr. Chomienne is author of more than 270 peer-reviewed publications and has received several scientific (Academia of Science) and French governmental awards (Chevalier et Officier de la Legion d'Honneur).*

09:50 - 10:05 **Cathrin BRISKEN** (Ecole Polytechnique Fédérale Lausanne)

Challenges and opportunities in cancer prevention

*Cathrin Brisken is professor at Ecole Polytechnique Fédérale Lausanne and at the Institute of Cancer Research, London.*
*She obtained MD and PhD in Biophysics at Göttingen University, Germany, was postdoc at the Whitehead Institute, MIT, and held appointments at MGH, Harvard, Boston and ISREC, Lausanne. She was Dean of the EPFL Doctoral School, serves on international committees and advisory boards and cofounded the International Cancer Prevention Institute.*

10:05 - 10:20 **Questions & Answers**

**10:20 - 10:30 Break**

| 10:30 - 12:15 | Panel 1 | Diagnostic support to clinicians |
|---|---|---|
| 10:30 - 10:35  | **Klaus HAUPT** (European Research Executive Agency) | Chair<br>*Head of Unit A1, MSCA Innovative Training Networks* |
| 10:35 - 10:45  | **Michael HUEBEL** (Directorate-General for Energy) | Moderator<br>*Michael Huebel is a political scientist. Worked for youth and social welfare organisations, including the German Red Cross. Joined the Commission in 1995, in the Health DG. Head of Unit for Health Determinants (2005-2012), Programme Management and Diseases (2013-2015), and Crisis Management and Preparedness in Health. Since 2017 in DG Energy, Head of Unit, Radiation Protection and Nuclear Safety.* |
|  | **Georgi SIMEONOV** (Directorate-General for Energy) | Contributor<br>*Georgi Simeonov is a physicist. Worked in the Bulgarian public administration on environmental protection and nuclear regulation issues. Joined the Commission in 2008 in the DG Energy, Radiation protection Unit. Policy Officer for medical applications of nuclear and radiation technology.* |
| 10:45 - 11:00  | **Martin GÖTTE** (Münster University Hospital) | Matrix glycans as multifunctional pathogenesis factors and therapeutic targets in cancer (H2020-MSCA-RISE-2014 project 645756 - GLYCANC)<br>*Martin Götte is Professor for Medical Biochemistry at the Department of Gynecology and Obstetrics, University of Münster, Germany. His research covers various aspects of gynaecological oncology and reproductive biology. Prof. Götte has coordinated 3 EU-H2020-MSCA-RISE projects. He has authored ~150 publications in peer-reviewed journals. His work has been cited more than 7000 times (h-index=42).* |

11:00 - 11:15 **Valentin NICA** (Italian Institute of Technology)

Development of novel approaches using trimagnetic nanoparticles for intracellular hyperthermia of prostate cancer cells (H2020-MSCA-COFUND-2017 project 800924 - iCARE-2)

*Valentin Nica received his Ph.D. in Physics (with honours) in 2009. He gratefully acknowledges a Socrates scholarship at Saarland University, Germany, where he developed a new method of determination of Curie temperature of magnetic nanoparticles (MNPs) in dispersion, a paramount importance for magnetic hyperthermia treatment. During his post-doctoral experience in Romania and Germany he worked on the improvement of efficiently targeting and releasing an anti-neoplastic agent to cancer cells. His work continued on the novel thermally stimuli-responsive systems via surface-functionalized magnetic nanoparticles at cell-level hyperthermia, MRI and on-command drug release.*

11:15 - 11:30 **Daniel ABLER** (University of Applied Sciences Western Switzerland)

Patient-specific tumour growth model for quantification of mechanical 'markers' in malignant gliomas: Implications for treatment outcomes (H2020-MSCA-IF-2016 project 753878- GlimS)

*Daniel Abler investigates image analysis and mathematical modeling approaches for oncology at the University Hospital of Lausanne (CH) and the University of Applied Sciences Western Switzerland (CH). After completing his Ph.D. in 2014 (University of Oxford, UK; CERN, CH), he has been a postdoctoral fellow, and a MSCA-IF Global Fellow at the University of Bern (CH) and the City of Hope National Medical Center (CA, USA).*

11:30 - 11:45 **Zahra EL-SCHICH** (Malmö University)

Imaging and detection of tumor-associated glycan structures on tumor cells (H2020-MSCA-ITN-2016 project 721297 - GlycoImaging)

*Zahra El-Schich received her Ph.D. from Malmö University in Biomedical Sciences in 2016 with a thesis in novel imaging technology and tools for biomarker detection in cancer. She continued her work as a postdoctoral fellow at the Institute for Biomedical science at Malmö University (2017-2020). Her ongoing work concerns in vitro studies for the development of advanced 3D cell models and tools for inhibiting virus binding.*

11:45 - 12:15 **Panel Discussion**

**12:15 - 14:00 Lunch break**

## 14:00 - 15:45 Panel 2 — Drug development and therapy

14:00 - 14:05 **Monika HOLIK** (European Research Executive Agency)

Chair

*Head of Unit A3, MSCA Research and Innovation Staff Exchange*

14:05 - 14:15

**Ioannis VOULDIS** (Directorate-General for Research and Innovation)

Moderator

*Ioannis Vouldis is a Scientific Policy and Programme Officer at the European Commission - Directorate General for Research and Innovation. He is in charge of a portfolio of EU funded research projects in cancer and is actively involved in the 'Horizon Europe Cancer Mission' development. Prior to joining the Commission in 2015, he carried out research and worked in the areas of biomedicine and pharmaceuticals in several centres and international organisations across Europe, including the European Medicines Agency and the United Nations. Trained as biochemist, he holds his PhD in molecular oncology from the School of Medicine at the Technical University of Munich.*

**Christoph Schultes** (MERCK Group)

Contributor

*Christoph Schultes is a Program Lead in the Oncology Development Unit at Merck KGaA in Darmstadt, Germany. Having held various positions in clinical research and External Innovation, he has for the past 5 years been responsible for leading program teams on assets in the company's oncology portfolio, with a focus on the early development space. Prior to joining Merck in 2010, Christoph was involved in spinning out a start-up from the EMBL in Heidelberg, Germany. He holds a PhD from the University of London School of Pharmacy and an MSci from Imperial College, London.*

14:15 - 14:30

**Breandán KENNEDY** (University College Dublin)

Drug Discovery and Delivery NEtwork for ONcology and Eye Therapeutics (H2020-MSCA-RISE-2016 project 734907 - 3D NEONET)

*Breandán Kennedy is Professor of Pharmacology at University College Dublin. His expertise is in phenotype-based drug discovery using bespoke zebrafish lines and progressing hits into in vitro/in vivo mammalian models and ex vivo patient cancer explants. He has a particular interest in uveal melanoma, a rare cancer, but the most common intraocular malignancy in adults. He is an inventor on 9 granted patents and currently co-ordinates two MSCA RISE industry academia consortia.*

14:30 - 14:45

**Nanasaheb THORAT** (University of Oxford)

Photo/magnetic stimulated nanocargos for superior cancer treatments (H2020-MSCA-IF-2016 project 751903 - NANOCARGO)

*Nanasaheb Thorat is an Experienced Researcher currently working as a Marie Curie Fellow Research Scientist at the University of Oxford, Medical Science Division. Dr. Thorat has published 55 articles, he filled1 international and 1 European patent, registered 2 European innovations/inventions, and contributed to 5 Books, 10 book chapters; he presented several Keynote Speeches and invited lectures. Dr. Thorat is the awardee of the European Commission's Innovation Radar "Grand Prix of the Innovation Radar Prize 2020".*

14:45 - 15:00

**Claus Storgaard SØRENSEN** (University of Copenhagen)

Targeting SYNthetic lethal interactions for new cancer treatments TRAINing network (H2020-MSCA-ITN-2016 project 722729 – SYNTRAIN)

*Claus Storgaard Sørensen is a human biologist from the University of Copenhagen. Following training in Milan and Copenhagen, he set up his own lab at the Biotech Research and Innovation Centre (BRIC), University of Copenhagen. The overall goal of his research is to understand mechanisms underlying maintenance of genomic stability in mammalian cells. These pathways are crucial in cancer development as well as in most cancer treatments. Particular focus is on familial cancers (breast and ovarian) and the responses to radiation. Research findings are largely based on genetic and proteomic screens, where we uncover and characterize new major*

*factors in cancer-related pathways.*

15:00 - 15:15 **Oleksii RUKHLENKO** (University College Dublin)

Investigation of adaptive design and rewiring of Survival-Apoptosis-Mitogenic (SAM) signalling transduction network (H2020-MSCA-IF-2016 project 750688 – SAMNets)

*Oleksii Rukhlenko obtained his PhD in 2013 at Moscow Institute of Physics and Technology (MIPT). Then he briefly held positions in the National Research Centre for Haematology (Moscow) and in MIPT. Since 2015 he is working in Prof. Boris Kholodenko group (University College Dublin), initially as a postdoc, then as MSCA Fellow, and after as a Research Scientist.*

15:15 - 15:45 **Panel Discussion**

**15:45 - 16:00 Break**

## 16:00 - 17:45 Panel 3 — Immunotherapy

16:00 - 16:05 **Fredrik OLSSON HECTOR** (European Research Executive Agency)

Chair

*Head of Unit A4, MSCA COFUND, Researchers' Night and Individual Fellowships: Global*

16:05 - 16:15 **Jan-Willem VAN DE LOO** (Directorate-General for Research and Innovation)

Moderator

*Jan-Willem van de Loo, Cancer Theme Lead since 2019, has been a Policy and Scientific Officer at the European Commission in charge of cancer, since 2003. He has extensive experience with project management, international cancer research & innovation policy activities and stakeholder interactions. He graduated in Biology at the University of Utrecht in 1991, after a year at the UW-Madison Medical School Graduate Program. He worked as a junior scientist on blood coagulation at Sanquin, Amsterdam and obtained his PhD in cell biology at the Centre for Human Genetics at the University of Leuven in 1999. He held three postdoctoral positions in cancer research, including a Marie-Curie postdoctoral fellowship at the European Institute of Oncology in Milan.*

16:15 - 16:30 **Jana BURKHARDT** (University of Leipzig)

Blocking Inhibition of T-cell Co-stimulation for Anti-tumour Therapy (H2020-MSCA-IF-2015 project 708169 – BITCAT)

*Jana Burkhardt studied biochemistry and medicine, holding a PhD and a medical license. She built up groups funded by BMBF and Fraunhofer society to research cell and gene therapy. Supported by a MSCA, she joined McMaster University, focusing on cancer immunotherapy. Upon return to Germany, she joined the private sector and also continues to pursue her research at the University of Leipzig.*

16:30 - 16:45

**Edwin BREMER** (University Medical Center Groningen)

Immune DIREcted and Cancer-selective immunoTherapy (H2020-MSCA-ITN-2018 project 813871 - I-DireCT)

*Edwin Bremer received his PhD in 2006 'Cum Laude' at the University of Groningen on design of immunotherapy with TNF ligands. He is currently tenure track Professor and head of the section Immunohematology of the Department of Hematology at the University Medical Center Groningen (UMCG) and processing facility director of the Stem Cell Transplantation Centre of the UMCG.*

16:45 - 17:00

**Jara PALOMERO GORRINDO** (Vall d'Hebron Institute of Oncology)

In-depth profiling of neoantigen specific-lymphocyte subsets with superior traits for personalized Tcell therapies (H2020-MSCA-COFUND-2017 project 801370 - BP3)

*Jara Palomero Gorrindo has always been interested in combining basic and translational biomedical research in order to develop new therapies to cure human pathologies. She has worked in several multidisciplinary and international environments and become largely experienced in tumor biology and immunology. Her current postdoctoral research aims to develop the next generation of cancer immunotherapies.*

17:00 - 17:15

**Rubí Misol-Há VELASCO CÁRDENAS** (Albert-Ludwigs-University of Freiburg)

European Network on Anti-Cancer Immuno-Therapy Improvement by modification of CAR and TCR Interactions and Nanoscale Geometry (H2020-MSCA-ITN-2016 project 721358 - EN_ACTI2NG)

*Rubi Misol-Há Velasco Cardenas is a PhD student at the University of Freiburg. After doing obtaining an MSCA in Cancer Immunology and Biotechnology in England, she started her PhD as part of the ENACTI2NG MSCA-ITN network. She is translating recent discoveries in the T Cell Receptor (TCR) to improve Chimeric Antigen Receptor (CAR) T cell therapy. She has participated in international conferences and worked as a co-author in 4 publications.*

17:15 - 17:45 **Panel Discussion**

**17:45 - 18.45** **Poster Session** **Live chat with poster presenters of panels 1 and 2**

~~~~~~~~~~~~~~~~ *end of day 1*~~~~~~~~~~~~~~~~
~~~~~~~~~~~~~~~~

## DAY 2 - Friday 19 March

| 9:00 - 10:45 | Panel 4 | Prevention and personalized medicine |
|---|---|---|
| 09:00 - 09:05  | **Monika HOLIK** (European Research Executive Agency) | Chair<br>*Head of Unit A3, MSCA Research and Innovation Staff Exchange* |
| 09:05 - 09:15  | **Laura GARCIA IBANEZ** (Directorate-General for Research and Innovation) | Moderator<br>*Laura García Ibáñez holds a PhD in Immunology by the University of Birmingham (UK) and further research experience in haematological cancers during her postdoctoral time at the University of Columbia (NY, USA). Currently, she is a Project Officer in the Directorate of Research and Innovation in the Unit of "Combatting diseases" and part of the Cancer team. She contributes to the advancement of Cancer-related research policies and manages Horizon 2020 projects.* |
| 09:15 - 09:30  | **Josep RUBERT** (Wageningen University & Research) | A novel integrative strategy to prevent colorectal cancer within the diet-host-microbiota triangle: from organoids to human in vivo reality (H2020-MSCA-IF-2017 project 794417 – TRIANGLE)<br>*Josep Rubert works at Wageningen University & Research as an Assistant Professor - Tenure track. In recent years, Dr. Rubert started to cross the boundaries between different disciplines. In this line, he led TRIANGLE, a MSCA-IF project, investigating how diet and gut microbiota can prevent disease risks, such as colorectal cancer.* |
| 09:30 - 09:45  | **Anna EROL** (Medical University of Bialystok) | Transcriptomic landscape of ovarian cancer through mRNA sequencing (H2020-MSCA-COFUND-2016 project 754432 – ImPRESS)<br>*Anna Erol graduated in Biology at Technical University of Dresden. She participated in research exchanges in Jan Evangelista Purkyne University in Usti nad Labem and the Stephan Angeloff Institute of Microbiology in Plovdiv. Within her International Interdisciplinary PhD studies in Biomedical Research and Biostatistics, she is focusing on ovarian cancer and cancer stem cell topics.* |

09:45 - 10:00 **Ulrich GUENTHER** (Universität zu Lübeck)

Deciphering the Metabolism of Haematological Cancers (H2020-MSCA-ITN-2015 project 675790 – HaemMetabolome)

*Ulrich Günther is Professor of Metabolomics at the University of Lübeck. He built the HWB-NMR facility at the University of Birmingham as a leading UK and European NMR centre, with involvements in many European infrastructure and research projects. His engagement in metabolomics research includes real-time metabolism, tracer-based methods in particular to study metabolism in cancer cells, metabolomics in a medical context (with recent work on the effect of COVID-19 on the blood metabolome) and metabolomics in a nutritional context. He has been coordinator of several MSCA-ITN networks, all focussed on NMR-methods and tracer-based metabolism.*

**Jan Jacob SCHURINGA** (University Medical Center Groningen)

*Jan Jacob Schuringa started his own lab at the University Medical Center Groningen in 2004, after finishing his postdoctoral studies at the Memorial Sloan-Kettering Cancer Center (New York, USA). His research focuses on intra and inter clonal diversity in human leukemias, particularly in the perspective of differences in signal transduction, organization of the epigenome and metabolism.*

10:00 - 10:15 **Petra THALLER** (Outdoor against Cancer - OAC Europe)

Outdoor against Cancer: move yourself, go out and live! (ERASMUS+ programme, project OAC: my goal)

*Petra Thaller holds M.Sc. in Communication Sciences, M.Sc. in Economics and M.Sc. in Psychology. She was the CEO of Thaller Media GmbH, Mountains4U, first European tablet magazine for mountain sports and outdoor activities. Currently, she is the founder and CEO of Outdoor against Cancer, OAC Europe*

10:15 - 10:45 **Panel Discussion**

**10:45 - 11:00 Break**

## 11:00 - 12:45 Panel 5 — Quality of life of patients and survivors

11:00 - 11:05 **Klaus HAUPT** (European Research Executive Agency)

Chair

*Head of Unit A1, MSCA Innovative Training Networks*

11:05 - 11:15 **Ciaran NICHOLL** (Directorate-

Moderator

General Joint Research Center)

*Ciarán Nicholl obtained his PhD in cancer research at Heidelberg University (DE), an MSc degree at Kingston University and Kings College Hospital (UK) and a BSc degree in Chemistry at Galway University (IE). He joined the European Commission's Joint Research Centre (JRC) as a post-doctorate fellow in 1995 and worked in JRC communications until 2012. In this period he oversaw nine JRC annual reports, 700 events including 3 open days (with over 25,000 participants) press media relations and web communications. Since 2013, Ciarán is head of the Health in Society unit in the JRC's Directorate for Health, Consumers and Reference Materials. Together with 45 staff, the unit is responsible for: 1. The European Commission's Initiatives on Breast and Colorectal Cancers, 2. The European Cancer Information System and the European Network of Cancer Registries, 3. The EU Platform for Rare Diseases Registration which also hosts the European Central Registries for Congenital Anomalies and Cerebral Palsies, 4. The Health Promotion and Disease Prevention Knowledge Gateway.*

11:15 - 11:30

**Brian CAULFIELD** (University College Dublin)

Activating Technology for Connected Health (H2020-MSCA-ITN-2016 project 722012 – CATCH)

*Brian Caulfield is currently the Director of the SFI Insight Centre for Data Analytics at University College Dublin. With a background in physiotherapy, his research is focused on the application of digital supports and data driven technologies for better understanding and enhancement of human behaviour and performance in health and sport. This work involves collaboration with partners in academia, healthcare, industry and sport.*

11:30 - 11:45

**Cathriona KEARNS** (University College Dublin)

TACTIC - TAiloring the Communication of risk To Individual breast Cancer patients (H2020-MSCA-COFUND-2015 project 713279 - CAROLINE)

*Cathriona Kearns is a medical epidemiologist and behavioural scientist with an academic and career history revolving around decision making under uncertainty, knowledge transfer and risk communication. She has provided policy evaluation on health service delivery to governments most recently to the Northern Ireland Legislative Assembly. She undertook her MSCA-COFUND fellowship at University College Dublin.*

11:45 - 12:00

**Laura FACHAL** (Wellcome Sanger Institute)

RADIOGENOMICS: Finding Genetic Functional Variants Through Fine Mapping (H2020-MSCA-IF-2014 project 656144 – RADIOGENFF)

*Laura Fachal devoted her PhD studies to understand the role of common genetic variation in the development of radiation induced toxicity during cancer treatment. Her work as a postdoc was to determine, through fine mapping, how common variants increase the risk of developing breast cancer risk and radiation induced toxicity. She is interested in understanding the biological mechanisms through which genetic variation affects complex phenotypes.*

| | | |
|---|---|---|
| 12:00 - 12:15 | **Christian OCHOA ARNEDO** (Catalan Institute of Oncology)  | Digital integration of Psychosocial Care and Health Education services (EITHealth, project ONCOMMUN)<br>*Cristian Ochoa Arnedo is a clinical psychologist involved in cancer psychosocial care throughout his career. In recent years, he aligned his consolidated lines of research in psychosocial care with the current digital transformation to facilitate healthy cancer experiences. The mission of his research is to reduce the impact of cancer and construct new wellbeing by improving access and pathways to receive psychosocial care during cancer journey. He is Head of the e-health program at the Catalan Institute of Oncology; director of psychosocial and e-health oncology research group in IDIBELL research foundation; and Associate Professor at the University of Barcelona.* |
| 12:15 - 12:45 | **Panel Discussion** | |
| **12:45 - 14:30** | **Lunch break and poster session** | **Live chat with poster presenters of panels 3, 4 and 5 (12:45-13:45)** |

| | | |
|---|---|---|
| **14:30 - 16:00** | **Panel 6** | **Policy round table and funding opportunities** |
| 14:30 - 14:35 | **Fredrik OLSSON HECTOR** (European Research Executive Agency)  | Chair<br>*Head of Unit A4, MSCA COFUND, Researchers' Night and Individual Fellowships: Global* |
| 14:35-14:45 | **Claire Morel** (Directorate-General for Education, Youth, Sport and Culture)  | Moderator<br>*Claire Morel is the Head of unit in charge of the Marie Skłodowska-Curie Actions for the mobility and training of researchers and the development of excellent doctoral programmes, at the European Commission. Before that, she was Head of Unit for international cooperation at DG Education, Culture, Youth and Sport of the European Commission, with particular focus on the international dimension of the Erasmus+ programme and international policy dialogues in higher education and youth issues with various partners of the EU in the world. She has worked several years with the countries neighbouring the EU. Before that, she worked for the Tempus programme (for higher education modernisation), cooperating with Central Asian countries, and for the European Training Foundation, an agency of the EU based in Turin, on the reform of vocational education and training systems in the Eastern neighbouring countries and Central Asia.* |
| 14:45 - 16:00 | **Panel discussion** | |

**Barbara KERSTIENS** (Directorate-General for Research and Innovation)

Contributor

*Barbara Kerstiëns, MD, MPH is the Head of Unit in the unit responsible for 'Combatting Diseases' in the PEOPLE Directorate of the Directorate-General for Research and Innovation at the European Commission.*
*She has a long experience in international public health, working for Médecins Sans Frontières, Johns Hopkins Bloomberg School of Public health and DG Development and Cooperation of the European Commission prior to joining DG Research and Innovation in 2012 where she has consistently worked in medical research and funding.*
*Barbara Kerstiëns received her M.D. from the Katholieke Universiteit Leuven, a Postgraduate Certificate in Tropical Medicine from the Institute of Tropical Medicine in Antwerp and a Master of Public health from Johns Hopkins Bloomberg School of Public Health.*

**Stefan SHRECK** (Directorate-General for Health and Food Safety)

Contributor

*Between 1997 and 2008, Dr Schreck has been working in the public health directorate of the European Commission in Luxemburg, in particular in the areas of communicable diseases, health threats, and substances of human origin. In 2008, he became head of the health unit in the executive agency for health and consumers (EAHC), with responsibility for implementing the EU health programme. In January 2011, he was appointed head of the health information unit of DG SANCO, with responsibility for health information policy, and providing the secretariat for the non-food scientific committees of the European Commission. From February 2016 to November 2020, he was head of the DG SANTE unit 'health programme and chronic diseases', dealing with policies for all non-communicable diseases, planning and drafting annual work programmes of the EU health programme, and contributing to the implementation of the health cluster of the Horizon Europe. Since December 2020, he is adviser for stakeholder relations in the Public Health Directorate of DG SANTE.*

**Vanessa DEBIAIS SAINTON** (Directorate-General for Education, Youth, Sport and Culture)

Contributor

*Vanessa Debiais-Sainton is Head of the Unit in charge of Higher Education policies and programme at the European Commission's Directorate General for Education, Youth, Sport and Culture. The unit is the lead service for European policies on reform and transformation of higher education, the new European Universities initiative, automatic mutual recognition of higher education qualifications, the creation of the EU student card, and the higher education strand of Erasmus+. In previous posts in the European Commission, Vanessa has worked in DG Research and Innovation. Before moving to the European Commission in 2006, Vanessa spent eight years working for several petroleum and chemical companies.*

**Jan-Philipp BECK** (EITHealth)

Contributor

*Jan-Philipp Beck is CEO of EIT Health and chairs the organisation's Management Board. He was appointed to the position on 1 February 2018. Jan-Philipp is passionate about transforming healthcare in Europe through partnership and innovation. As CEO, his overarching objective is to support EIT Health's vision of connecting the healthcare needs of European citizens with policy makers and its incredible network of over 140 partners to deliver innovative healthcare solutions that can positively transform healthcare outcomes across Europe. He joined EIT Health in 2015 from EY and previously Deloitte, where his work involved supporting industry, universities and research organisations with the development and roll-out of R&D, innovation projects and related financing concepts.*
*Prior to this, he was Executive Director of the European Youth Parliament, an educational project of the Schwarzkopf-Stiftung in Berlin, where he oversaw the organisation's work connecting over 30,000 young people a year across 34 countries. He holds a MA in*

*Political Science, Economics and English from Eberhard Karls Universität Tübingen in Germany.*

**Marisa FERNANDEZ ESTEBAN** (Directorate-General for Education, Youth, Sport and Culture)

Contributor

*Marisa Fernández Esteban holds a degree of Law from the Autonoma University of Madrid, with ERASMUS award for her academic semester at the University of Amsterdam. She holds a PHD in European Law from the European University Institute in Florence. She was a lecturer of European and Constitutional Law at the Autonoma University of Madrid before joining the European Commission where she has dealt with accession negotiations, copyright and audiovisual legislation. Between 2014 and 2015 she was the assistant to the Director General of DG EAC. She is currently the deputy head of the sport unit. She is the author of 3 academic books on European Law.*

**Pierre MEULIEN** (Innovative Medicine Initiative)

Contributor

*Pierre Meulien is executive director of the Innovative Medicines Initiative (IMI), a €5 billion public-private partnership between the European Union and the European pharmaceutical industry. At IMI, he is responsible for the overall management of the program, which works to improve and accelerate the drug development process by facilitating collaboration between the key players involved in health research. Previously, Dr Meulien was president and CEO of Genome Canada, where he raised money and oversaw the launch of novel projects and networks in the field of genomics-based technologies. Prior to that, he was chief scientific officer for Genome British Columbia and was the founding CEO of the Dublin Molecular Medicine Center. Dr Meulien also worked with the French biotechnology company Transgene and with Aventis Pasteur (now Sanofi Pasteur). He has a Ph.D. in molecular biology from the University of Edinburgh and carried out a postdoctoral fellowship at the Institut Pasteur in Paris.*

**16:00 - 16:20** **Break**

## 16:20 - 17.00 Closing Session

16:20 - 16:25

**Begoña ARANO** (European Research Executive Agency)

Chair

*Head of Department A - Excellent Science*

16:25 - 16:30 **Poster award - winner presentation**

16:30 - 16:45 **Dimitris L. KONTOYIANNIS** (Aristotle University of

Scientific Expert remarks

*Dimitris L. Kontoyiannis, PhD, is Associate Professor of Cell Biology at the School of Biology of the Aristotle University of Thessaloniki.*

Thessaloniki)

*He is also Affiliated Investigator of the Biomedical Sciences Research Centre (BSRC) "Alexander Fleming" in Vari, Greece. His group uses mammalian models and phenotypic approaches to investigate the functions of RNA regulators in immunopathology and cancer.*

**Marusela OLIVERAS SALVA** (Intellectual property and innovation expert)

Innovation Radar Expert remarks

*Marusela Oliveras Salva studied Biomedicine at the University of Barcelona and holds a PhD in Biomedical Sciences by KU Leuven. She worked as a technology transfer officer at IRB Barcelona and as business development manager at Erasmus MC (Netherlands). She became a Registered Technology Transfer Professional (RTTP) in 2016. She currently works as Senior Intellectual Property and Commercial Research Manager at Guy's and St Thomas' Hospital in London.*

16:45 - 17:00

**Jean-Bernard VEYRET** (European Research Executive Agency)

Closing remarks and wrap-up of event

*Head of Unit A2, MSCA Individual Fellowships: European*

# G. E-Posters' Presenters

## 1. DIAGNOSTIC SUPPORT TO CLINICIANS

**P2**

**Maurizio CALLARI**
*University of Cambridge, UNITED KINGDOM*

**BRIDGES**
Bioinformatic approaches to identify and detect both disease- and drug-related genomic alterations in breast cancer patients (H2020-MSCA-IF-2014**)**
*Dr. Maurizio Callari completed his Degrees at the University of Milan, graduating in Functional genomics and Bioinformatics. He completed his PhD at Istituto Nazionale dei Tumori in Milan, working on the identification of prognostic/predictive signatures in breast cancer. In 2014 he moved to the CRUK Cambridge Institute to work on breast cancer genomics and single-cell data to study tumour heterogeneity.*

**P3**

**Oliver DIAZ MONTESDEOCA**
*University of Barcelona, SPAIN*

**SCARtool**
Scattered radiation reduction tool to improve computer-aided diagnosis performance in digital breast tomosynthesis (H2020-MSCA-IF-2014)
*Assistant Professor at the University of Barcelona (ES), Dr Diaz Montesdeoca holds a PhD in Medical Imaging from the University of Surrey (UK). He has 10+ years international experience in breast cancer research using Artificial Intelligence and was awarded with a MCSA Postdoctoral Fellowship in 2015. He is member of several EU working groups on cancer related issues and has participated in 17 research projects.*

**P4**

**Sertan SUKAS**
*Eindhoven University of Technology, THE NETHERLANDS*

**pureCTC**
A lab-on-a-chip device for pure circulating tumor cell isolation from whole blood for cancer therapy (H2020-MSCA-IF-2016)
*Dr. Sertan Sukas is a mechanical engineer by training and received his PhD in nanotechnology in 2013. Since then, he has been working on developing microfluidic tools for quantification, identification, and analysis of circulating tumor cells in both academic and industrial settings. He is currently a postdoctoral researcher at Eindhoven University of Technology in The Netherlands.*

**P5**

**Yağmur YILDIZHAN**
*Katholieke Universiteit Leuven, BELGIUM*

**AiPBAND**
An Integrated Platform for Developing Brain Cancer Diagnostic Techniques (H2020-MSCA-ITN-2017)
*Yağmur Yıldızhan obtained a B.Sc. in Physics at Bilkent Univeristy and a M.Sc. in Mechatronics Engineering at Sabanci University (Turkey), focused on dielectrophoretic separation of tumor cells. Since 2018, she is pursuing a Ph.D. in Biosensors group (KU Leuven, Belgium) in the framework of MSCA ITN project AiPBAND. She is working on developing FO-SPR and digital ELISA for sensitive detection of extracellular vesicles.*

**P6**

**Manuel S RODRIGUEZ**
*Centre national de la recherche scientifique, FRANCE*

**UbiCODE**
European Research Training to Decipher The Ub Code: identification of potential biomarkers and drug targets (H2020-MSCA-ITN-2017)
*Dr Rodriguez obtained his PhD degree at Pasteur Institute/Paris 7 University. After two post-doctoral appointments at St Andrews University (UK) and Jacques Monod Institute (France), he directed a group at CICbioGUNE and Inbiomed (Spain). He integrated the CNRS in 2001 and recently obtained a research director position. He is specialised in the study of the role of ubiquitin family members in cancer.*

**P8**

**Rafael MORALES**
*University of the Basque Country & Basque Center for Materials, SPAIN*

**MAGNAMED**
Novel magnetic nanostructures for medical applications (H2020-MSCA-RISE-2016)
*Dr. Morales is Ikerbasque Research Professor at the University of the Basque Country and the Basque Center for Materials, Applications and Nanostructures. He completed a PhD in Physics in 2002. Currently, he is interested in the magnetic properties of materials at the nanometer scale, new phenomena, and their potential for medical applications in diagnosis and therapy.*

**P9**

**Roman VITER**
*University of Latvia, LATVIA*

**CanBioSe**
Novel 1D photonic metal oxide nanostructures for early stage cancer detection (H2020-MSCA-RISE-2017)
*Dr. Viter obtained a PhD degree in Physics in 2011. In 2012-2014 he was a post-doctoral fellow at the University of Latvia, and then obtained a position as leading researcher. In 2019 he became a head of laboratory. Dr. Viter implements research projects and reviews for journals and national foundations. He has 79 papers and h-index 25. His current research interests include metal oxide nanocomposites, biosensors, and photocatalysis.*

**P10**

**Simone DETASSIS**
*Optoi SRL, ITALY*

**miRNA-DisEASY**
microRNA biomarkers in an innovative biophotonic sensor kit for high-specific diagnosis (H2020-MSCA-RISE-2015)
*Dr. Simone Detassis holds a Master in Cellular and Molecular Biotechnology and a PhD (Doctor Europaeus) in Biomolecular Sciences at the University of Trento (Italy). He worked as a researcher in miRNA-DisEASY commuting across Spain, Germany and Brazil. He is currently an assay developer at OPTOI implementing microsensing optical platforms for biomedical applications.*

**P11**

**Martin STEINBERG**
*A3P Biomedical, SWEDEN*

**STOCKHOLM3**
Transforming prostate cancer detection (EITHealth Programme)
*Born in 1969. MBA at Stockholm School of Economics. Co-founder of A3P Biomedical AB. Martin Steinberg has more than 15 years' experience of working in interface between academia and industry. Former Investment Manager with venture capital firm Litorina Kapital and Manager with Arthur D. Little.*

## 2. DRUG DEVELOPMENT AND THERAPY

**P12**

**Fernando TORRES ANDON**
*Universidade de Santiago de Compostela, SPAIN*

**NANOTAM**
Development and Evaluation of Nanomedicines for Cancer Treatment through Immunomodulation: Targeting Tumor-Associated Macrophages (H2020-MSCA-IF-2014)
*Dr Fernando Torres Andón is a researcher in Nanomedicine for Cancer Immunotherapy at the University of Santiago de Compostela (2019-present). He is Pharmacist with a PhD in Molecular Biology by ULPGC (Spain, 2010). He performed a postdoc in Nanotoxicology at Karolinska Institutet (Sweden, 2011-2013) and a postdoc in Cancer Immunotherapy at Istituto Clinico Humanitas (Italy, 2014-2018).*

**P13**

**Maria Teresa VALERO GRINAN**
*The University of Edinburgh, UNITED KINGDOM*

**BRAINHIB**
Integrated drug discovery approach to generate brain-penetrant inhibitors of glioblastoma cell proliferation (H2020-MSCA-IF-2016)
*Teresa Valero Grinan obtained her PhD from the University of Freiburg, as ESR of a MSCA ITN. After, she worked for a SME EU Project as Principal Investigator. In 2014, she worked on target deconvolution tools as COFUND MSCA fellow at the University of Edinburgh (UoE) and Granada (UGR). After a lectureship in Pharmacology at Bradford University, she joined the UoE as MSCA-IF Fellow (2018), working on inhibitors against brain cancer.*

**P14**

**Aurélie LACROIX**
*Sixfold Bioscience, UNITED KINGDOM*

**NANORNA_PC**
Engineering the protein corona on RNA nanoparticles for improved nucleic acids-based therapies delivery (H2020-MSCA-IF-2019)
*Aurélie Lacroix works as a MSCA fellow at Sixfold Bioscience. The start-up, based in London, develops RNA-based nanostructures for cancer therapies and delivery of gene therapeutics. Aurélie's research aims at studying how RNA 3D nanostructures interact with serum proteins. Prior to joining Sixfold, Aurélie completed her PhD at McGill University with Prof. Sleiman, where she studied the fate of DNA nanoparticles in biological conditions.*

**P15**

**Carsten P WELSCH**
*University of Liverpool and The Cockcroft Institute, UNITED KINGDOM*

**OMA**
Optimization of Medical Accelerators (H2020-MSCA-ITN-2015)
*Prof. Welsch studied physics and economics at the Universities of Frankfurt and Berkeley; he completed his PhD in accelerator physics in 2002. He has been academic staff member at the University of Liverpool since 2008, leading the physics department since 2016. His research focuses on beam instrumentation, beam dynamics and accelerator applications with a focus on medical accelerators.*

**P16**

**Soraya LELOUCHE**
*IMDEA Energy Institute, SPAIN*

**HeatNMof**
Heating triggered drug release from nanometric inorganic-metal organic framework composites (H2020-MSCA-ITN-2019)
*Soraya Lelouche obtained a BSc in chemistry from the University of Montpellier (2016). She pursued her studies with an Erasmus Mundus Master in material science, MaMaSELF (2016-2018), between the University of Turin (UniTo), the Ludwig Maximilian University (LMU) and the Smart Materials Research Institute. She joined the Advanced Porous Materials unit of*

*IMDEA Energy as a predoctoral researcher, as a part of the MSCA-ITN-2019 project HeatNMof in September 2021.*

**P18**

**Miguel CASTANHO**
*University of Lisbon, PORTUGAL*

**INPACT**
Innovative peptides against cancer and pathogenic bacteria, with advances in science, biopharmaceutical drug development, product market targeting, training , and communication (H2020-MSCA-RISE-2014)
*Miguel Castanho's expertise in the design and study of membrane-active peptides with activities ranging from Antiviral, Antimicrobial, Anticancer, Analgesic and Drug delivery using experimental methods and structural biology approaches. One of the focuses of his research group is the study of peptide drugs able to transmigrate across the Blood-Brain-Barrier and target the Central Nervous System.*

**P19**

**Eduardo GUISASOLA**
*CIC biomaGUNE, SPAIN*

**OXIGENATED**
Hemoglobin based Protein Nanocarriers for Tumour Oxygenation and a more effective Photodynamic Therapy (H2020-MSCA-RISE-2018)
*Eduardo Guisasola obtained his PhD in Pharmacy from the Universidad Complutense de Madrid in 2016. After a period working for the industry, he has held a jointly post doctoral position in the Soft Matter Nanotechnology and Biomolecular Nanotechnology laboratories at CIC biomaGUNE, Spain, focusing his work on protein-polymer nanocarriers for cancer treatment through photodynamic therapy.*

**P20**

**Kateřina STAŇKOVÁ**
*Maastricht University, THE NETHERLANDS*

**FourCmodelling**
Conflict, Competition, Cooperation and Complexity: Using Evolutionary Game Theory to model realistic populations (H2020-MSCA-RISE-2015)
*Kateřina Staňková is an associate professor in dynamic game theory, focusing on both theory and applications of dynamic games. She has led one of the work packages of MSCA-RISE project FourCModelling, aiming at improving cancer treatment through evolutionary game theory. She coordinates the ITN project "EvoGamesPlus", which is the only ITN proposal in mathematics funded in 2020. Find more on www.stankova.net.*

**P21**

**Marco CASSANI**
*St Anne's University Hospital, CZECH REPUBLIC*

**iCARE-2**
Mechanobiology of nanoparticle-cell interactions to develop therapies against cancer (H2020-MSCA-COFUND-2017)
*Marco Cassani earned his PhD in Nanochemistry from the Italian Institute of Technology of Genoa in 2018. Later, he moved to the University of Melbourne where he extended his expertise in nanomedicine and bio-nano interactions. He is currently MSCA fellow at the International Clinical Research Center of Brno. He is author of papers in international journals and holder of a patent.*

**P22**

**Martin PRUSCHY**
*University of Zurich, SWITZERLAND*

**THERADNET**
International NETwork for training and innovations in THErapeutic RADiation (H2020-MSCA-ITN-2019)
*Dr Pruschy holds a professorship in Applied Cancer Research at the University of Zurich, and he is a staff member of the Dept. of Radiation Oncology, University Hospital Zurich. He holds a PhD in Life Sciences from the ETH-Zurich, and his interdisciplinary research interests are situated at the interface of Basic and Applied Radiation Biology with a strong intersectoral relationship to pharmaceutical research.*

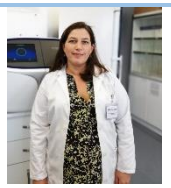
**P23**

**Laura SOUCEK**
*Vall d'Hebron Institute of Oncology, Peptomyc S.L., SPAIN*

**PEPTOMYC**
Reimagining cancer treatment through MYC inhibition (EITHealth Programme)
*Laura Soucek graduated in 1996 in Biol. Sciences at Uni. La Sapienza in Rome, Italy. She obtained her PhD in Genetics & Mol Biol in 2001. She then joined UCSF as a postdoc, and in 2006 as Associate Researcher. Since 2011, she is PI at the Vall d'Hebron Inst. of Oncology (VHIO), in Barcelona, Spain. In 2014 she was appointed ICREA Research Prof. and in 2015 Assoc. Prof. at the Uni. Autónoma de Barcelona. In 2014 she founded Peptomyc S.L.*

## 3. IMMUNOTHERAPY

**P24**



**Isabel BARRAGAN**
*University Hospital of Malaga (Virgen de la Victoria), SPAIN*

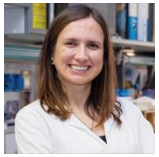
**IMMUNOMARK**
Omics integration for precision cancer immunotherapy (H2020-MSCA-IF-2017)
*Pharmacologist and Geneticist, Dr Barragan devotes her research to Pharmaco(epi)genetics and Cancer Immunotherapy. Principal Investigator of "Intercentros" Immuno-Oncology section and affiliated to Karolinska Institutet, she has been MSCA fellow in two occasions. She seeks disease mechanisms and biomarkers amenable for targeted manipulation, combining genetic and epigenetic analyses of clinical samples.*

**P25**

**Samanta Romina ZANETTI**
*Josep Carreras Leukemia Research Institute, SPAIN*

**InTheMLLrBALL**
Innovative Therapeutic Strategies for Mixed Lineage Leukemia-rearranged B-cell Acute Lymphoblastic Leukemia (H2020-MSCA-IF-2017)
*Dr Zanetti started her scientific life several years ago in Argentina. In 2012, she became a scientific Career Member of CONICET (Argentina), as an Assistant Researcher. In 2018, she was awarded with a MSCA IF to join IJC (Spain). Now, she is finishing 2 projects that are part of her granted proposal based on CAR-T cell therapy and immune checkpoints blockers for Acute Lymphoblastic Leukemia.*

**P27**



**Eliana RUGGIERO**
*San Raffaele Hospital, ITALY*

**THAT IS HUNT**
Triggering Haematological Adoptive T-cell Immunotherapy Strategies by Hunting Novel T-cell receptors (H2020-MSCA-IF-2016)
*Eliana Ruggiero received her PhD from the University of Heidelberg (Germany). In 2015 she joined the Experimental Hematology lab (PI:Chiara Bonini) at OSR (Italy) with the aim of identifying new tumor-specific TCRs for cancer immunotherapy. For her scientific achievements, she received national and international fellowships, grants and awards. Her work resulted in 23 publications and 2 patents.*

**P28**

**Miika MARTIKAINEN**
*Uppsala University, SWEDEN*

**AVITAG**
Alphaviral Immunotherapy against Glioblastoma (H2020-MSCA-IF-2015)
*Miika Martikainen received his PhD from University of Eastern Finland in 2015. In 2016, with a MSCA IF grant he started his postdoctoral research at Uppsala University in the Cancer Immunotherapy group led by Professor Magnus Essand. The main focus of his research is developing novel oncolytic agents for glioma immunotherapy.*

**P29**

**Federica CAPPELLESSO**
*Vlaams Instituut voor Biotechnologie – Katholieke Universiteit Leuven, BELGIUM*

**META-CAN**
Targeting the metabolism-immune system connections in Cancer (H2020-MSCA-ITN-2017)
*Federica Cappellesso holds a Master in Molecular biology from the University of Padova. She finalized her master thesis in the laboratory of Prof. Antonella Viola focusing on the role of ATP as an inter-cellular communication molecule between macrophages. She is now enrolled as a PhD student in the group of Prof. Mazzone at KU Leuven, where she studies the role of bicarbonate transporters in the development and immune response of pancreatic cancer.*

**P30**

*No photo*

**Albrecht SCHWAB**
*Westfälische Wilhelms-Universität Münster, GERMANY*

**pHioniC**
pH and Ion Transport in Pancreatic Cancer (H2020-MSCA-ITN-2018)
*After studying medicine in Würzburg, Dr Schwab obtained his postdoctoral training at Yale, Vanderbilt and Würzburg Universities. In 2003 he became professor at the Institute of Physiology II. His research focuses on the function of ion channels and ion transporters in migrating cells such as tumor (stroma) cells and immune cells. MSCA-ITN project pHioniC is the successor of the ITN IonTraC, which he was also coordinating.*

**P31**

**Sebastian KOBOLD**
*Klinikum der Universität München, GERMANY*

**T-OP**
Training Network for Optimizing Adoptive T cell Therapy of Cancer (H2020-MSCA-ITN-2020)
*Sebastian Kobold is Professor of Medicine and Experimental Immuno-oncology at the Medical Faculty of LMU München. He is board certified clinical pharmacologist and immunologist. The focus of Dr. Kobold´s research work is on developing novel cellular therapy approaches against cancer and deciphering novel resistance mechanisms that need to be overcome for T cell activity.*

**P32**

**Endre KISS-TOTH**
*University of Sheffield, UNITED KINGDOM*

**TRAIN**
Tribbles Research and Innovation Network (H2020-MSCA-ITN-2016)
*Endre Kiss-Toth is a Professor of Cell Signalling, with a long term interest in the control of immune cell signalling in health and disease. His work in recent years have focussed on molecular mechanisms that regulate inflammatory responses in macrophages and the impact of these on prostate and breast cancers, in particular.*

## 4. PREVENTION AND PERSONALIZED MEDICINE

**P33**

**Alice O'FARRELL**
*RCSI University of Medicine and Health Sciences, IRELAND*

**GLIOTRAIN**
Exploiting GLIOblastoma intractability to address European research TRAINing needs in translational brain tumour research, cancer systems medicine and integrative multi-omics (H2020-MSCA-ITN-2017)
*Dr Alice O'Farrell is the Project Manager for GLIOTRAIN, a MSCA-ITN project. She was previously a post-doctoral researcher at RCSI, and has a research background in tumour biology and pre-clinical cancer research.*

**P34**

**Eleonora PAULETTO**
*Karlsruher Institut fuer Technologie, GERMANY*

**TRIM-NET**
Training network in drug discovery targeting TRIM Ubiquitin ligases in disease (H2020-MSCA-ITN-2018)
*Eleonora Pauletto graduated in Pharmaceutical Chemistry and Technology at the University of Trieste in 2017. She carried out her master's thesis in the group of Gaiddon and Mellitzer at INSERM in Strasbourg, where she worked on a new class of potential anticancer drugs. In June 2019, Eleonora joined the group of C. Blattner at KIT and TRIM-NET to work towards her PhD on TRIM25 in prostate cancer.*

**P35**

**Hannes BODE**
*Institute for Molecular Medicine, FINLAND*

**CANCERPREV**
Innovative strategies for cancer prevention with focus on sex hormone signaling and chronic inflammation (H2020-MSCA-ITN-2019)
*The doctoral studies of Hannes Bode at the Helsinki University are focusing on the investigation of heritable and environmental factors in breast cancer discordant twin pairs. I am using the twins' shared genetic and environmental background in describing their breast cancer discordance. With this approach I seek to find additional regulation factors for breast cancer as a complex multi-level disease.*

## 5. QUALITY OF LIFE OF PATIENTS AND SURVIVORS

**P36**

**Prashanth Lakshmi NARASIMHAN**
*Eindhoven University of Technology, THE NETHERLANDS*

**ElectroPros**
Training research pioneers by utilizing and validating the promise of electroporation for minimal invasive oncological treatments (H2020-MSCA-ITN-2018)
*Prashanth L. is a Marie Curie Fellow in the ElectroPros project, involved in the development of optimal treatment planning strategy for liver tumors. He received a MSc degree in Computational Mechanics from Swansea University, UK and Centrale Nantes, France in 2019. His research interests are in the areas of Computational mechanics, Surrogate modelling, Uncertainty quantification and Optimization.*

**P37**

**Julien MOUSSALLI**
*WeFight, FRANCE*

**WEFight**
Holistic health apps for chronic disease management (EITHealth Programme)
*Julien Moussalli is leading business development activities at Wefight. The mission of his team is to collaborate with pharmaceutical companies globally to enhance their capacity to understand and take into consideration the patient voice. Prior joining Wefight, Julien worked during 4 years at IQVIA, a global consulting firm specialized in healthcare.*

**P38**

**Anne-Marie HEEGAARD**
*University of Copenhagen, DENMARK*

**BonePainII**
A European Training Network to Combat Bone Pain (H2020-MSCA-ITN-2018)
*Anne-Marie Heegaard, MD, PhD is an Associate Professor at the Department of Drug Design and Pharmacology, University of Copenhagen. Her focus is translational research in malignant and non-malignant bone pain. Dr. Heegaard is the coordinator of the MSCA-ITN-2018-ETN: BonePainII (2019-2022).*

# H. Abstracts – oral presentations

**GLYCANC**

## Matrix glycans as multifunctional pathogenesis factors and therapeutic targets in cancer

**H2020-MSCA-RISE-2014; Grant No. 645756**

Cancer is a leading cause of mortality within the aging European population and implies high costs for the general public. Recent research showed that sugars called glycosaminoglycans (GAGs) and glycoproteins called proteoglycans (PGs) influence tumor growth and metastasis. The GLYCANC consortium hypothesized that PG and GAG-based drugs will stop multiple processes of cancer development and will be superior to existing therapeutics. Understanding of how these sugars work, how they are regulated, and how this knowledge can be used for drug development was a major objective of GLYCANC, in addition to developing new analytical technologies called spectroscopy and atomic force microscopy. With exchanges of university- and industry-based researchers between Europe, South America and Asia, GLYCANC provided excellent interdisciplinary training for young scientists which became specialists in an upcoming and important research field. GLYCANC has substantially enhanced our understanding how proteoglycans regulate all relevant steps of tumor progression, has resulted in the development of new analytical techniques, and in the development of new glycoscience-based therapeutic approaches.

**iCARE-2**

## Development of novel approaches using trimagnetic nanoparticles for intracellular hyperthermia of prostate cancer cells

**H2020-MSCA-COFUND-2017; Grant No. 800924**

The project aims to develop and optimize new shape-anisotropic MNPs that could be efficiently applied for intracellular hyperthermia of prostatic cancer cells (PCa). We will use a PC-3 human metastatic cancer cell line characteristic of prostatic small cell carcinoma. The focus is to obtain a significant enhancement of SAR of MNPs when are subjected to an AMF, a paramount property to attain the hyperthermic effect at single-cell level with minimized toxicity. For a precise quantitative evaluation of the hyperthermia therapy response *in vitro* and *in vivo*, we will use a high performance near-field scanning optical microscopy (neaSNOM®) which enables to mapping the cellular receptors and to analysis the proteins in cells structure. We therefore address *in vitro* and *in vivo* studies on the interactions of MNPs within the living biological tissue under an applied AMF, and their heat effect at single-cell level.

**GlimS**

## Patient-specific tumour growth model for quantification of mechanical 'markers' in malignant gliomas: Implications for treatment outcomes

**H2020-MSCA-IF-2016; Grant No. 753878**

Glioblastoma (GB) is the most frequent malignant primary brain tumor in adults and associated with dismal prognosis. Its growth is characterized by healthy tissue infiltration and rapid growth, often leading to tissue compression. The resulting mechanical stresses cause functional loss and trigger changes in the tumor micro-environment that can enhance GB aggressiveness. However, GB's biomechanical impact is poorly characterized and not used to inform treatments. The GlimS project developed and evaluated image-based computational methods for characterizing GB growth using mathematical modeling approaches and public GB MR-imaging data. GlimS demonstrated that infiltrative and displacive growth tendencies of individual tumors can be quantified from anatomical MRI routinely acquired in clinical practice. Additionally, the developed methods allow computation of the tumor-induced mechanical stresses in the patient's brain. By enabling quantitative assessment of the mechanical impact of GB tumors, the methodological developments of GlimS provide a basis for further research into tumor growth phenotypes with distinct biomechanical stress profiles and their clinical significance.

## GlycoImaging

### Imaging and detection of tumor-associated glycan structures on tumor cells

**H2020-MSCA-ITN-2016; Grant No. 721297**

A major challenge in the war against cancer is to find ways to diagnose and treat the disease at an early stage. Cancer occurs through a multistage process where cells are transformed to malignant tumors. Of essence is to discover the tumor at an early stage where the cancer is still curable. This calls for sensitive and effective diagnostic tools that can sense the cellular state early in the process. In GlycoImaging we are addressing this need while exploiting novel molecularly imprinted polymers (MIPs) targeting glycans that are relevant for tumors. These "plastic antibodies" are developed for real-time visualization of cellular cancer biomarkers and for the future in low-cost clinical diagnostics. The sialic acid-imprinted MIPs have been tested extensively *in vitro* for targeting glycans by using methods such as flow cytometry, digital holographic cytometry and fluorescence microscopy. An *in vitro*-based circulating tumor cell model is under development. The *in vivo* administration in mice have shown that the choice of fluorophore is important for the detection of the MIPs. Further, MIPs against the tumor specific target STn are under development.

## 3D NEONET

### Drug Discovery and Delivery NEtwork for ONcology and Eye Therapeutics

**H2020-MSCA-RISE-2016; Grant No. 734907**

3D-NEONET is a European consortium of 20 partners based in 7 countries exchanging skills to accelerate therapies for oncology and ophthalmology. 18 million people were diagnosed with cancer and 10 million people lost their lives to cancer in 2020, making it a leading cause of pre-mature mortality. Hallmarks of severe ocular vasculopathies e.g. angiogenesis, inflammation and vascular permeability also play pivotal roles in cancer, therefore are therapeutic targets for both indications. Through participation in MSCA RISE, 3D-NEONET is driving synergies between its academic and non-academic partners, with an overall aim of enhancing drug discovery, development and delivery in oncology and ophthalmology. Specific examples of innovative cancer research in 3D-NEONET are the following collaborations: 1) University College Dublin (UCD), Trinity College Dublin (TCD) and Xenopat (Barcelona) advancing drug development for uveal melanoma and colorectal cancer through bespoke patient-derived xenograft (PDX)-models; and 2) UCD, TCD and Bioreperia (Linköping) utilising zebrafish tumour xenograft technology for drug development in cancer (see https://pubmed.ncbi.nlm.nih.gov/33066024/).

**NANOCARGO**

## Photo/magnetic stimulated nanocargos for superior cancer treatments

**H2020-MSCA-IF-2016; Grant No. 751903**

There have been significant advancements in the treatment of breast cancer in recent years but the mortality rate remains high. Surgery, radiation and chemotherapies are still main pillars cancer treatments. All these therapies have major disadvantage, such as lack of specificity, adverse toxic effects on normal organs, poor bioavailability of chemotherapeutic drugs, and development of resistance to treatment. In view of the severe and widespread mortality and morbidity associated with breast cancer, there is serious unmet clinical need for new therapeutic approaches for, effective targeted therapy and therapy monitoring to tackle the cancer in advanced clinical stage. The NANOCARGO provides methods, systems, and devices for performing synergetic cancer therapy (e.g., to treat breast cancer). The innovative method comprises using two treatment modalities to synergistically treat primary tumour cells in a subject. The NANOCARGO develops breast tumor targeted synergistic combination provides a rapid, safe, and effective treatment of local and distant lesions, better than each modality alone.

**SYNTRAIN**

## Targeting SYNthetic lethal interactions for new cancer treatments TRAINing network

**H2020-MSCA-ITN-2016; Grant No. 722729**

Breast and ovarian cancer constitute serious health challenges in the EU, they are among the leading causes of death among women. The SYNTRAIN ETN consortium has aimed to innovate breast and ovarian cancer therapeutic options through new concepts originating in basic science settings. These were multi-facetted synthetic lethal approaches, which took advantage of the inherent genetic instabilities of cancer cells that constitute actionable weaknesses. Through a variety of genetic and proteomic screens, SYNTRAIN research has led to the identification of new druggable targets and pathways. These targets have been carefully investigated to uncover their potential as drug targets. Furthermore, compound discovery and development has also been an important part of SYNTRAIN leading to patents and patent submissions to exploit our discoveries.

**SAMNets**

## Investigation of adaptive design and rewiring of Survival-Apoptosis-Mitogenic (SAM) signalling transduction network

**H2020-MSCA-IF-2016; Grant No. 750688**

Oncogenic mutations in the RAS genes are one of most frequent oncogenic mutations in cancer. Despite long effort at developing RAS inhibitors, targeted therapies are available only for a minor subgroup of RAS mutations. Clinically used RAF and MEK inhibitors are ineffective in RAS-mutant tumours, although RAF/MEK/ERK pathway is a main effector downstream of RAS. A way to overcome resistance is the use of inhibitor combinations, but it is unclear how the best combinations can be chosen. Using a combined experimental and computational approach, we have built a mechanistic model that integrates both structural features of proteins and drug-protein interactions, and network-wide signalling effects to faithfully predict drug responses at the network level. Our model predicted that a counter-intuitive combination of two RAF inhibitors targeting different conformation of the same kinase can synergistically suppress oncogenic

RAS signalling. Subsequent experiments on a wide spectrum of RAS-mutant melanoma, acute myeloid leukaemia, colorectal and pancreatic cancer and cell lines corroborated modelling predictions, demonstrating strong synergy of model-predicted drug combinations.

**BITCAT**

## Blocking Inhibition of T-cell Co-stimulation for Anti-tumour Therapy

**H2020-MSCA-IF-2015; Grant No. 708169**

While our immune system is effective at detecting and fighting abnormal cancer cells as well as infections, tumours have developed evasive tactics, such as producing immune suppressive signal molecules. The MSCA supported BITCAT project developed a proof-of-principle for drugs to overcome this strategy. Artificial immune receptors called chimeric antigen receptors (CARs) were genetically engineered and introduced into immune cells. These CAR T cells showed promise as a treatment, especially for malignant glioblastoma (GBM). First, a number of target antigens on the surface of malignant cells were identified. Two suitable ligands, which bind those antigens, were chosen to have their genetic sequence engineered, forming the basis of the CAR therapy. GBM cells were exposed to these CAR cells, resulting in highly efficient killing of tumour cells with minimum impact on healthy tissue. Survival in a tumour bearing animal model of GBM was increased by 50 % and 63 %, respectively. As GBM is one of the most aggressive cancers and survival rates of just 12-16 months following diagnosis have hardly improved at all, results of this project might make a real clinical difference in the future.

**I-DireCT**

## Immune DIREcted and Cancer-selective immunoTherapy

**H2020-MSCA-ITN-2018; Grant No. 813871**

Immunotherapy with checkpoint inhibitors that remove the ‘brake’ from tumour-directed T cells has yielded unprecedented clinical responses in many types of cancer. However, curative treatment is still the exception and is restricted to a subset of tumour entities. Further, current immunotherapeutics can trigger severe dose-limiting (auto)immune-mediated toxicity. Indeed, the overwhelming majority of current checkpoint inhibitors and costimulatory reagents are ‘simple’ monoclonal antibodies and have no intrinsic selectivity for the tumour or for tumour-reactive immune cells. I-DireCT aims to develop second-generation immunomodulatory drugs that trigger anti-tumour immunity without or at least with strongly reduced toxicity. Specifically, we will develop antibody-based therapeutics with latent agonistic activity that is unmasked only in the tumour micro-environment. Further, by incorporation into tailored polymeric nanoparticle drug delivery systems, these novel therapeutics will be optimally formulated to have active targeting to the tumour site and decreased off-target accumulation.

**BP3**

## In-depth profiling of neoantigen specific-lymphocyte subsets with superior traits for personalized Tcell therapies

**H2020-MSCA-COFUND-2017; Grant No. 801370**

In the last years there has been a striking boom in immunotherapies (ITs) against cancer, and accumulating evidence supports that lymphocytes targeting non-self neoantigens arising from tumor-specific genetic alterations play an important role in the antitumor efficacy of cancer ITs. Despite the advances in the

therapeutic potential of tumor-reactive and neoantigen-specific T cells for some cancer patients, a very important factor hindering their clinical impact is the lack of knowledge about their differentiation status and (dys)functional capacities. We propose to integrate data generated from a personalized high-throughput screening approach to identify CD4+ and CD8+ neoantigen-specific lymphocytes together with functional assays, TCR clonogenicity and single-cell RNA sequencing. With this combinatorial approach we will directly interrogate the T-cell receptor of the tumor-reactive and neoantigen-specific T cells and characterize their (dys)functional states. Thus, we will identify novel biomarker/s to enrich for tumor-reactive and neoantigen-specific T cells with better capabilities for adoptive cell transfer, paving the way for the next generation of personalized cancer ITs.

**EN_ACTI2NG**

**European Network on Anti-Cancer Immuno-Therapy Improvement by modification of CAR and TCR Interactions and Nanoscale Geometry**

**H2020-MSCA-ITN-2016; Grant No. 721358**

EN-ACTI2NG is a H2020-MSCA-funded training network that aims to improve cellular cancer immunotherapy by combining biophysical, cellular, molecular and pre-clinical research on TCR, CAR and co-receptor function. We focussed on the initiation of TCR signalling that involves phosphorylation of its immunoreceptor tyrosine-based activation motifs (ITAMs) by the tyrosine kinase Lck. CARs are recombinant receptors that direct T cells toward cancer cells. Current CARs use ITAMs from the TCR to activate T cells. We aimed to elucidate how Lck is initially recruited to the TCR to apply this knowledge to the design of improved CARs. We report a new binding motif in CD3ε that interacts in a noncanonical mode with the Lck SH3 domain: the receptor kinase (RK) motif. It is accessible only upon TCR ligation, demonstrating how ligand binding leads to Lck recruitment. Binding of Lck to the RK motif resulted in local augmentation of Lck activity, CD3 phosphorylation, T cell activation and thymocyte development. Introducing the RK motif into a 41BB-based CAR enhanced its antitumor function, underscoring how a better understanding of the TCR promotes rational improvement of CAR design for the treatment of cancer.

**TRIANGLE**

**A novel integrative strategy to prevent colorectal cancer within the diet-host-microbiota triangle: from organoids to human in vivo reality**

**H2020-MSCA-IF-2017; Grant No. 794417**

Colorectal cancer (CRC) is the second cause of death in the EU, with one million cases seen annually worldwide. In the light of these figures, and associated costs, there is an overwhelming need to prioritize and integrate primary prevention measures. The forecasts show that the global burden of CRC is expected to increase by 60% due to an aging population and western dietary patterns. Dietary patterns, or the food we eat, are the sum of a multitude of molecules. After being ingested and digested, nutrients are altered by microorganisms that inhabit our gastrointestinal tract, modifying bioavailability and biological effects. Dietary patterns and the gut microbiota modulate the production of gut microbial metabolites (GMMs). TRIANGLE studied the mechanisms by which specific GMMs affect the gut epithelium. First, I established human colon organoids and tumoroids closely recapitulating homeostasis and carcinogenesis. Secondly, diet-gut microbiota interactions were evaluated using an in vitro gastrointestinal model. Lastly, human colon organoid/tumoroids responses to GMMs were evaluated by 3D imaging techniques and multi-omics approaches.

**ImPRESS**

## Transcriptomic landscape of ovarian cancer through mRNA sequencing

**H2020-MSCA-COFUND-2016; Grant No. 754432**

Ovarian cancer is the most lethal form of gynaecologic cancers and the main challenges to overcome are its fast-developing treatment resistance, often too late diagnosis leading to fast progression and metastasis. Advances in life science technologies allow us to look closer and more precise than ever at different levels of cancer biology networks. Using a data-driven approach, we can use generated data to set a base for various approaches to better understand cancer biology, to find biomarkers and novel drug targets. This gain of knowledge helps us to set up personalised, precise medicine. In the research project, we are using patient-based gene expression and non-coding RNA expression results for a deeper understanding of high-grade serous ovarian cancer. We are applying many approaches, such as differential gene expression, weighted gene co-expression network analysis, functional analysis, competing for endogenous RNA network construction and drug repurposing approaches to add knowledge allowing us to reach goals of the Europe Beating Cancer Plan by building on the promise of personalised medicine for cancer prevention, diagnosis and treatment.

**HaemMetabolome**

## Deciphering the Metabolism of Haematological Cancers

**H2020-MSCA-ITN-2015; Grant No. 675790**

The HaemMetabolome project was focused on metabolism in haematological cancers. It included cancer cell biologists along with bioanalytical experts and groups focussing on computational modelling. The main focus of HaemMetabolome was on haematological cancers, specifically on acute myeloid leukaemia (AML), a blood cancer driven by a combination of mutations leading to a malignant transformation of cells. The project used mass spectrometry (MS) and nuclear magnetic resonance (NMR) techniques to screen haematological cancer cell lines and primary patient samples for their metabolic phenotypes. They also performed gene-function analyses on key metabolic regulators. Specific aspects of the project were focused on metabolic transformation towards hypoxic metabolism, metabolic consequences of the interaction of AML and stromal cells and enhanced dependency on glutaminolysis and reduced proliferation in vitro and in vivo in humanized niche xenograft mouse models. Overall, the project showed that human leukaemias display distinct metabolic states that can serve as targets for treatment.

**OAC: my goal**

## Outdoor against Cancer: move yourself, go out and live!

**ERASMUS+ programme**

The main goal of the OAC: my goal project was to create awareness about the health-promoting effects of outdoor activities on the well-being of cancer patients. Outdoor activities during therapy and follow-up show positive effects, not only on physiological functions (fatigue, polyneuropathy, quality of life), but also on mortality risk. OAC: my goal focused on high participation of cancer patients and their families and friends in outdoor activities and events.
GOALS ACHIEVED:
1. Provide access to outdoor activities for cancer patients, their families and friends

2. Provide evidence-based knowledge on the situation of cancer survivors in relation to access and participation in outdoor activities in after care.
3. Disseminate knowledge and evidence to encourage patients to break down their own barriers and participate in outdoor activities.
4. Thanks to the OACatHome videos in four different languages (New Intellectual Output, due to COVID 10 Pandemic) and the digitization of the OAC training developed within the project by OAC Europe, independent of the project, guarantee the continuity of the project beyond the project period.

**CATCH**

**Activating Technology for Connected Health**

**H2020-MSCA-ITN-2016 ; Grant No. 722012**

In recent years we have seen an increased understanding of the importance of rehabilitation in cancer care. However, successful implementation of rehabilitation in cancer patients comes with very significant challenges. The CATCH Industrial Doctoral programme investigated how advances in digital technologies could support cancer rehabilitation and overcome these challenges. It brought partners from healthcare, academia and the digital health industry together to train 8 PhD researchers who addressed the challenge across 3 interrelated research work packages; 'Understanding the Problem,' 'Technology Interventions', and 'Sell and Scale'. The objective was to deliver targeted research outputs related to each PhD project, as well to use the overall programme as a means of developing a model for interdisciplinary research at the intersection between ICT, clinical and commercial sectors. Our goal was to produce a cohort of PhD graduates who will drive future innovation in technology enabled cancer rehabilitation through interdisciplinary understanding and innovation.

**CAROLINE**

**TACTIC - TAiloring the Communication of risk To Individual breast Cancer patients**

**H2020-MSCA-COFUND-2015; Grant No. 713279**

Globally breast cancer is the most common cancer and leading cause of cancer death in women. Earlier diagnosis and treatment have resulted in increased survival over the past decade. Breast cancer is a complex disease with the aim of treatment and care, beyond prolonging life, to ensure a high quality of life (QoL) for patients. Treatment regimens can be long, and effects of post therapeutic comorbidity can be debilitating, with many patients experiencing a repertoire of symptoms detrimental to their QoL. The complexity of the disease, diagnostic results and treatments can make it difficult for those affected to fully comprehend the risks involved and the effects of decisions being made. Studies on cancer quality of care demonstrated a need for improved documentation to facilitate patients' understanding of their disease, to aid the transition to survivorship and to reduce fragmentation in care. Taking a patient centred approach to co-design a breast cancer treatment and survivorship plan, TACTIC created a 'tool' to aid clinical discussions, patient decision making, and coordination of aftercare. The 'tool' is now being piloted for implementation into cancer clinics.

**RADIOGENFF**

**RADIOGENOMICS: Finding Genetic Functional Variants Through Fine Mapping**

**H2020-MSCA-IF-2014; Grant No. 656144**

Radiogenomics is the study of the genetics of toxicity following radiotherapy. Unintended damage to normal tissues can severely affect up to 5% of patients for

years after completion of curative cancer radiotherapy. Previous genome-wide association studies (GWAS) identified genetic loci associated with development of radiation-induced toxicity phenotypes in local tissues of patients who underwent radiotherapy for prostate cancer. The latest meta-analysis included 3,871 men of European ancestry who underwent radiotherapy for prostate cancer. It identified three new regions in the genome, which were associated with rectal bleeding, decreased urinary stream, and hematuria. We carried out a fine mapping study in order to determine the independent association signals in each region, and to define the most likely causal variants driving each one of the signals. We identified four signals across the three known regions, two of them at the region associated with increased risk of developing hematuria. The rectal bleeding locus overlaps with active enhancer-like regions in gastrointestinal tissues. The two independent signals associated with hematuria were also associated with the expression of local protein coding genes. Further studies will be required to uncover the functional effects.

**ONCOMMUN**

## Digital integration of Psychosocial Care and Health Education services

**EITHealth programme**

Being diagnosed with cancer generates significant emotional distress in many patients (35% to 38%). On-going health education and psychosocial support in cancer is only accessible to 15–20% of European citizens. Considering that emotional distress tends to derive in poorer quality of life (QL), less adherence to oncological treatments, overall survival and self-care, it is relevant to react against this lack of attention. Oncommun is an innovative digital ecosystem to connect patients and professionals, combining well-established technologies to improve healthcare in cancer through a cohesive and attractive program. Oncommun implements a four-level stepped-care to respond timely and proportionally to the needs of each patient. Nearly, 1500 European citizens have been engaged in Oncommun during 2019-2020. Oncommun has demonstrated a gain of more than 20 healthy life years in the total sample analysed and a reduction of 31.15% in the total time for temporary leave for breast cancer. Moreover, more than 90% of users have remained within the first three preventive levels of attention. The proposal also shows high potential to buffer impact in emotional distress and quality of life during the first year in cancer journey.

# I. Abstracts – e-poster presentations

**P2 - BRIDGES**

## Bioinformatic approaches to identify and detect both disease- and drug-related genomic alterations in breast cancer patients

**H2020-MSCA-IF-2014; Grant No. 660060**

Breast cancer is the most common cancer among European women showing high clinical and molecular heterogeneity. Current clinical management causes patients overtreatment, while intrinsic or acquired tumor resistance to treatment leads to incurable metastatic progression in a proportion of patients. Advances in cancer genomics highlighted a high inter- and intra-tumor genetic heterogeneity, reinforcing the need for a mutation-based personalized treatment and a way to non-invasively monitor evolving disease. This project aimed 1) to develop new bioinformatics approaches to analyse and exploit large set of genomic and transcriptomic data from clinical specimens, liquid biopsy and pre-clinical models; 2) to identify candidate predictive biomarkers associated with response to treatment and enable their non-invasive assessment in a liquid biopsy.

**P3 - SCARtool**

## Scattered radiation reduction tool to improve computer-aided diagnosis performance in digital breast tomosynthesis

**H2020-MSCA-IF-2014; Grant No. 657875**

Breast cancer is the most common cause of cancer death in Europe for women, and the third most common cause of cancer death overall. Early diagnosis through screening programs is one of the main strategies for reducing these rates. X-ray mammography (MG) is the most widely used imaging technique for the early detection of this disease. However, digital breast tomography (DBT) is an imaging technology which has shown better detection rates and has great potential to replace MG in the future screening programs. DBT consists of the acquisition of images of the breast at different angles, thus allowing the generation of pseudo-3D images of the breast (2D images at different depths). However, DBT suffers from increased scattered radiation, a type of radiation that reduces the visibility of lesions in the image. SCARtool have been focused on the development of a computer-based tool to reduce such scattered radiation from MG and DBT clinically acquired images. Such tool has potential to significantly improve the detection of breast lesions using computer-aided detection (CADe) tools and reduce the mortality in breast cancer patients.

**P4 - pureCTC**

## A lab-on-a-chip device for pure circulating tumor cell isolation from whole blood for cancer therapy

**H2020-MSCA-IF-2016; Grant No. 752516**

Circulating tumor cells (CTCs) are rare cells that originate from tumors, and travel in the human circulatory system to eventually spread the disease to other organs. Consequently, analysis of CTCs is crucial for revealing the mechanisms of cancer and developing new treatments. However, only 1-10 CTCs are present per mL of blood against billions of blood cells. The extreme rarity and inherent heterogeneity of CTCs implies a single-cell analysis strategy. Therefore, a highly

selective, efficient and reliable system yet providing high throughput is required. Cell labeling based strategies are inefficient for CTC analysis, since CTCs express biomarkers with high heterogeneity. Label-free methods based on physical properties lack the ability to distinguish CTCs from leukocytes. To address these challenges, a microfluidic device for sensing tumor cells at the single-cell level was developed. Implementing electrical measurement techniques with a novel device technology, the new sensor proved its potential for discrimination of CTCs based on their electrical signature for fast and label-free detection without any pre-treatment.

**P5 - AiPBAND**

**An Integrated Platform for Developing Brain Cancer Diagnostic Techniques**

**H2020-MSCA-ITN-2017; Grant No. 764281**

In AiPBAND, we focus on gliomas, a range of progressive brain tumors without effective treatments or preventive strategies, aiming to generate biological data for developing innovative diagnostic techniques. So far, by mass-spectrometry proteomics we have identified/quantified over 2000 proteins in plasma of glioblastoma patients. Our studies on uncovering the influence of tumor microenvironment by single-cell genomics/spatial transcriptomics, deciphering serum miRNA and establishing a new mouse model of human astrocytoma are still ongoing. We designed a retrospective clinical trial to evaluate circulating miRNA, and we will develop a prospective clinical study for biomarkers evaluation. We also developed various biosensors for sensitive blood biomarker detection (e.g., miRNA, EVs), like SPR platforms, EGOFET and graphene-based biosensors. Furthermore, we established a mixture model for integrated differential expression analysis of RNA-seq data to discover potential biomarkers and a state-of-the-art deep learning model for tumor classification/patient stratification using multi-omics data. Finally, we aim to develop an innovative business model for early glioma diagnosis.

**P6 - UbiCODE**

**European Research Training to Decipher The Ub Code: identification of potential biomarkers and drug targets**

**H2020-MSCA-ITN-2017; Grant No. 765445**

Post-translational modifications by members of the Ubiquitin (Ub) family represent an efficient way to regulate protein function through changes in protein localisation, activity, interaction with partner proteins or stability, according to cell requirements. Defects in this homeostatic equilibrium result in pathologies such as cancer, among others. For this reason, this research area has become very attractive for fundamental scientists and for the pharmaceutical industry aiming to identify potential targets for therapeutic intervention. Ub family members are interconnected in various ways, forming intricate and complex heterologous chains that can also be modified by phosphorylation or acetylation. This unsuspected complexity is known as «The Ubiquitin Code». To decrypt this unexplored universal language requires joint collaborative multidisciplinary efforts, including the use of distinct molecular systems, model organisms and the latest technological developments to explore chemical, biochemical, molecular, pharmacological and clinical aspects of protein modification. UbiCODE represents an unprecedented effort to understand «The Ubiquitin Code» in an integrated manner.

**P8 - MAGNAMED**

## Novel magnetic nanostructures for medical applications

**H2020-MSCA-RISE-2016; Grant No. 734801**

The main objective of MAGNAMED 'Novel magnetic nanostructures for medical applications' is to explore the potential of a new kind of nanomagnets for cancer diagnosis and innovative therapeutic techniques. An important strategy to fight against cancer is the early stage detection of the disease. In this field, nanotechnology provides original approaches to develop highly sensitive and specific biosensors. The contribution of this project is to improve the detection limit of magneto-electrical platforms for the recognition of cancer biomarkers. Nanomagnets with special configurations will be designed and fabricated to enhance the sensitivity of magnetic-based biosensors, extending their detection limit allowing a timely detection of cancer. The project involves multidisciplinary teams from Physics, Chemistry, Biology, and Medicine. A challenging goal possible through the MSCA programme, promoting intersectoral and interdisciplinary research among fifteen partners; SMEs, academic organizations and research centers.

**P9 - CanBioSe**

## Novel 1D photonic metal oxide nanostructures for early stage cancer detection

**H2020-MSCA-RISE-2017; Grant No. 778157**

The project CanBioSe targeted to strengthen international and intersectoral collaboration, sharing new ideas and knowledge transfer from research to market and vice versa in the field of nanostructured metal oxide optical biosensors for cancer cells detection. Interdisciplinary project research and innovation goals are targeted to develop a new portable tool for early stage cancer detection. One dimensional (1D) polymer nanofibers will be deposited by electrospinning technique. Photonic nanomaterials, based on metal oxide based nanostructures (ZnO, ZnO/Al2O3 nanolaminates, etc.) will coat the 1D nanofibers. Metal oxides and Au nanoparticles will be deposited with Atomic Layer Deposition and electrophoresis, respectively. Bioselective layer will be formed by immobilization of specific antibodies on the biosensor surface. Photoluminescence and optical spectroscopy will be used for recording of the biosensor signal. Biosensor testing will be performed on cancer cells (human chronic lymphocyte leukemia leucosis and acute lymphoblastic leucosis). The biosensor will be integrated with microfluidic system in order to minimize dimensions and simplify the use of the detection system.

**P10 - miRNA-DisEASY**

## microRNA biomarkers in an innovative biophotonic sensor kit for high-specific diagnosis

**H2020-MSCA-RISE-2015; Grant No. 690866**

miRNAs are showing huge promise as clinical biomarkers for illness and disease. However, miRNA detection is still challenging nowadays, since costly, complex sample preparations and RNA amplifications are not yet reliable enough for clinical decision making. In this context, two innovative EU companies, OPTOI (IT) and DESTINA GENOMICS (ES) joined forces with 5 key partners as GeneXplain (DE) and from Universities of Trento (IT), Granada (ES), Hannover Medical School (DE) and Santa Catarina (BR). All the parties combined their knowledge with respect to miRNA biomarkers with a particular focus on lung cancer, to develop a novel and reliable miRNA detection system for this disease. To this end, research collaborations addressed the analysis of miRNAs differentially expressed in

lung cancer, continuing experimental work already started in the past years, but with greater integration and focus. In parallel, the consortium worked on a miRNA detection kit based on OPTOI detector and DESTINA technology for specific nucleic acid recognition, performing accurate direct detection of miR-21 in plasma of lung cancer patients without extraction, pre-amplification, or pre-labelling of the target.

**P11 - STOCKHOLM3**

**Transforming prostate cancer detection**

**EITHealth Programme**

Prostate cancer is the most common cancer among men in Europe. Early diagnosis can significantly reduce prostate cancer mortality. However, today's early diagnostic of prostate cancer, based on Prostate Specific Antigen (PSA) is too imprecise. Stockholm3 is a blood test developed by Karolinska Institutet that predicts the risk of aggressive prostate cancer. Stockholm3 finds 100% more aggressive prostate cancers and reduce 50% of unnecessary biopsies compared to PSA. Data from the pivotal study, including 58,000 men, was published in The Lancet Oncology. A total of EUR 75 million has been invested in clinical research, product development and market validation activities of Stockholm3. Leading Nordic Health care providers have replaced PSA with Stockholm3, and the test is currently being rolled out in Europe and elsewhere. The test has been used by more than 30,000 men in clinical practice. More information can be found on www.a3pbiomedical.com.

**P12 - NANOTAM**

**Development and Evaluation of Nanomedicines for Cancer Treatment through Immunomodulation: Targeting Tumor-Associated Macrophages**

**H2020-MSCA-IF-2014; Grant No. 658592**

Tumor-associated macrophages (TAMs) accumulate at high density in solid tumors and are key drivers of tumor progression. TAMs sustain immunosuppression in the tumor microenvironment (TME) and hinder the antitumoral efficacy of most treatments currently applied in clinical oncology, including immune checkpoint blockade inhibitors (ICIs). However, the plasticity and feasible functional re-education of TAMs into M1-like antitumor macrophages has been demonstrated, establishing these cells as promising targets for the treatment of cancer.

Our work is focused on the development of novel Therapeutic Nanostructures (TAM-TNs), containing immunomodulatory drugs and conveniently functionalized on their surface, to target and re-educate TAMs into M1-like antitumor macrophages, with ability to kill tumor cells, inhibit angiogenesis and promote adaptive immune responses. These TAM-TNs are evaluated in preclinical immunocompetent murine lung tumor models, alone or in combination with ICIs, to unleash effective anti-tumor immune responses in the TME. We expect that this approach will enable greater progress in the treatment of tumors and ultimately lead to improved outcomes for cancer patients.

**P13 - BRAINHIB**

**Integrated drug discovery approach to generate brain-penetrant inhibitors of glioblastoma cell proliferation**

**H2020-MSCA-IF-2016; Grant No. 749299**

Glioblastoma multiforme or glioma is the most aggressive cancer that begins into the brain. It affects around four to five per 100,000 adults per year in Europe, being the most common cancer of the central nervous system. Without treatment the average survival following diagnosis is only 3 months. This disease is considered an unmet medical need. One of the limitations to find new treatments is the presence of the blood brain barrier. The BRAINHIB project focused on designing new drugs to fight glioma. We aimed to design drugs that can penetrate through the blood brain barrier. The project combined research in chemistry with research in cellular biology. In the field of chemistry, it was based on combining chemical building blocks to construct new molecules. In the field of biology, it focused on improving current models to study the disease, including the use of cells that were extracted from patients upon surgery. Drugs were tested in these improved models, and best candidate drugs were further improved through chemistry, in several rounds. This iterative cycle finalises when one or several drugs efficiently stop the growth of glioma cells but do not affect the normal cells. The best candidate inhibitors (also known as “hits”) were then selected, and further studies performed to identify how the hits work.

**P14 - NANORNA_PC**

## Engineering the protein corona on RNA nanoparticles for improved nucleic acids-based therapies delivery

**H2020-MSCA-IF-2019; Grant No. 896167**

Nanoparticles aim to improve selectivity towards cancer cells while reducing off-target effects and toxicity towards normal cells. RNA nanoparticles have been of great interest for drug delivery, because of their high yielding assembly, retained functionality and biocompatibility. Yet, challenges such as poor nuclease resistance, biodistribution and cellular delivery remains to be addressed, to fully propel these structures towards clinical applications. There is a huge need to understand precisely their interactions with biological components. Upon injection in vivo, it is known that serum proteins adsorb on nanoparticles. The composition of this protein-corona on RNA particles remains fully unexplored. Herein, we describe methodologies developed to study the composition protein corona, as well as how we can alter its composition, and therefore impact the in vivo outcomes of such particles. The project, grouping experts in industry and in academia, aims towards the development of a preclinical candidate, as well as answering fundamental questions on nanoparticles delivery.

**P15 - OMA**

## Optimization of Medical Accelerators

**H2020-MSCA-ITN-2015; Grant No. 675265**

Cancer is a major social problem and the main cause of death between the ages 45-65 years. Radio therapy with protons and light ions, due to their unique physical and radiobiological properties, offers several advantages over photons for specific cancer types. In particular, they penetrate the patient with minimal diffusion, they deposit maximum energy at the end of their range, and they can be shaped as narrow focused and scanned pencil beams of variable penetration depth. The Optimization of Medical Accelerators (OMA) project joins universities, research centres and ion-beam treatment facilities together with leading industry partners, to address the challenges in ion beam cancer treatment facility design and optimization, numerical simulations for the development of advanced treatment schemes, beam imaging and treatment monitoring. R&D of the 16 OMA Fellows has significantly advanced knowledge in proton and ion beam therapy and related key technologies. Some project outcomes such as prompt gamma slit cameras, improved ion beam handling and extraction, as well as enhanced machine control software already benefit patient treatment at OMA facilities. In addition, results from studies into hard and software prototypes

that have reached technical maturity for evaluation in conditions closely mimicking treatment delivery show great promise for future therapy improvements.

### P16 - HeatNMof

**Heating triggered drug release from nanometric inorganic-metal organic framework composites**

**H2020-MSCA-ITN-2019; Grant No. 860942**

The HeatNMof research project aims to combine the highly porous and versatile structure of biocompatible nanoMOFs, associated with exceptional drug payloads and controlled releases, with plasmonic and magnetic inorganic NPs. Magnetic nanoparticles have become powerful tools in biotechnology and nanomedicine, due to the suitable penetration depth of AMF in tissue. Additionally, the ability of plasmonic NPs to drive photon-to-heat conversion has attracted much attention in the cancer therapy. The composites would provide both a specific control of reactions inside living entities and additional properties (imaging, hyperthermia therapy or targeting, among others) to develop multifunctional composite materials with enhanced performances. This research objective is strongly related with the prime training/networking aim to: Train the next generation of material scientists in a highly interdisciplinary and intersectorial research environment such that they can soundly address upcoming challenges concerning development, optimization and characterization of inorganic and porous hybrid materials and their interaction with living entities, with a focus on drug delivery nanosystems.

### P18 - INPACT

**Innovative peptides against cancer and pathogenic bacteria, with advances in science, biopharmaceutical drug development, product market targeting, training , and communication**

**H2020-MSCA-RISE-2014; Grant No. 644167**

INPACT aims at the pre-clinical development of innovative drugs and drug formulations against selected cancers (eg prostate cancer) and pathogenic bacteria (eg S. aureus). The INPACT consortium allies the expertise of both academic and industrial R&D partners that contribute with their own unique technologies to achieve new drugs that are only possible to develop in an integrative effort. Academic partners have unique knowledge and technologies on supercharged viral proteins-derived cell-penetrating peptides (eg from Dengue virus) and ultra-resistant cyclic peptides that may be transferred to the industrial partners, which in turn have specialized proprietary technologies on anticancer and/or peptide drugs' technologies. The judicious exchange of knowledge among partners will lead to new resistant peptides for trans-barrier delivery of drugs (eg cyclic peptide-drug chimeras) and bacterial killing (both planktonic and biofilms). INPACT includes four leading academic partners (from Portugal, Spain, Australia, and Brazil) and three consolidated biotech SMEs (one from Portugal and two Spain). In addition to the R&D project itself, INPACT involves at the highest possible level a top business school in Europe (IESE, Barcelona, Spain), a consolidated media partner specialised in science communication (Ciencia Hoje, Rio de Janeiro, Brazil) and experts in international science funding from one of the top US universities (University of Stanford). The consortium will be the perfect environment for young researchers to acquire knowledge and skills in science, technology, entrepreneurship, business, and communication so they can pro-actively tailor their career path in a life-long learning perspective. This is a contribution towards the advancement of Europe through the use of research and education for societal development and economic growth.

**P19 - OXIGENATED**

## Hemoglobin based Protein Nanocarriers for Tumour Oxygenation and a more effective Photodynamic Therapy

**H2020-MSCA-RISE-2018; Grant No. 823879**

A major drawback of Photodynamic Therapy (PDT) and other therapies for cancer treatment is the limited oxygen content, hypoxia, in tumour tissue. In PDT a photosensitizing molecule is delivered to malignant tissue to generate radical oxygen species (ROS). The presence of oxygen is fundamental for ROS generation, ultimately causing the death of tumour cells. This project aims to develop haemoglobin drug delivery nanocarriers in the nano and submicron range for simultaneous oxygen and photosensitizer delivery to tumour tissue for a more efficient Photodynamic Therapy. Hemoglobin-based nanocarriers (HOBCs) have been prepared by co-precipitation of haemoglobin with carbonates and surface coating with bovine serum albumin and polyelectrolytes. Photosensitizer molecules have been entrapped in the core and in the capsules. In vitro studies are currently being conducted to study the uptake of HOBCs by cells, their intracellular fate, toxicity, and oxygen and photosensitizer delivery. In a next step, the efficiency of the HOBCs for oxygen delivery and for PDT will be tested in vitro and in vivo in breast and skin cancer models.

**P20 - FourCmodelling**

## Conflict, Competition, Cooperation and Complexity: Using Evolutionary Game Theory to model realistic populations

**H2020-MSCA-RISE-2015; Grant No. 690817**

FourCModelling project has developed game-theoretical models, both general and focused on specific real population scenarios, which incorporate population structure and within-population interactions. The project contained 4 work packages: WP1 developed a general theory of multiplayer evolutionary games in structured populations. WP2 developed foraging games under time constraints and involving sequential decisions relating to patch choice. WP3 led to computational models of pandemics. WP4 focused on modelling cancer as a complex adaptive system and designing more effective cancer therapies. WP4 was carried out in collaboration with the Moffitt Cancer Center in Tampa, Florida, and contributed to the development of the so-called evolutionary (or adaptive) therapies for metastatic cancers. Such therapies anticipate and steer evolution of treatment-induced resistance in cancer cells. Initial clinical trials with these therapies suggest that they are much more effective than the standard of care. The follow-up project of the FourCModelling, EvoGamePlus, will train 15 Early Stage Researchers, focusing on both game theory and its applications in oncology and epidemiology.

**P21 - iCARE-2**

## Mechanobiology of nanoparticle-cell interactions to develop therapies against cancer

**H2020-MSCA-COFUND-2017; Grant No. 800924**

The study of cell mechanics and their complex interactions with nanomaterials are starting to emerge as a promising area of investigation in nanomedicine (1). In addition, the mechanical properties of cells have been recently proposed as new prognostic factors in cancer growth and dissemination. Therefore, mechanotargeting and mechano-therapeutics made their way through medical vocabulary to describe a new class of drugs and treatments targeting mechanically activated pathways involved in pathologies (2-3). By using nanoparticles with tunable size and surface coating, we demonstrate that the inhibition of mechano-regulated pathways - found responsible for cell stiffness regulation (4) - affects nanoparticles uptake in cancer cells. Remarkably, nanoparticles

internalization is independent of mechano-regulated pathways inhibition in healthy cells, where their activity is less pronounced. In conclusion, our study represents a proof-of-concept that the internalization of nanoparticles in target cells might be controlled by tuning cell mechanosensing pathways, ultimately improving the specific targeting and delivery of nanotherapies.

(1) Septiadi D., Crippa F., Moore T. L. et al., Advanced Materials, 30, 19, 2018; (2) Wei Q., et al., Advanced Materials, 30, 27, 2018; (3) Sheridan C., Nature Biotechnology, 37, 829-831, 2019; (4) Nardone G., Oliver-De La Cruz J. et al., Nature Communications, 8, 15321, 2017.

## P22 - THERADNET

### International NETwork for training and innovations in THErapeutic RADiation

**H2020-MSCA-ITN-2019; Grant No. 860245**

Radiotherapy alone or in multimodality approaches is applied in 45-60% of all cancer patients, but despite technical innovations approximately only 50% are cured. Substantial improvements are now expected from biologically optimized, personalized radiotherapy. The MSCA ITN THERADNET is built on the premises that integration of novel emerging radiobiological and tumor-biological concepts into current standard-of-care will improve outcome of radiotherapy-treated cancer patients. The partners in this network will stimulate outstanding science to understand the plasticity of an altered tumor metabolism and tumor microenvironment, including the immune system, prior to, and in response to radiotherapy, as well as related dose-limiting adverse effects in normal tissues. Research and development of novel combined treatment modalities in these areas will be performed in models as close as possible to the clinical situation to evaluate their potential to widen the therapeutic window beyond standard-of-care. Students will benefit from outstanding expertise and collaborations within academia and industry integrating novel concepts into translational cancer and radiation research.

## P23 - PEPTOMYC

### Reimagining cancer treatment through MYC inhibition

**EITHealth Programme**

MYC is one of the most wanted targets for therapeutic intervention in cancer, having a key role in driving and maintaining most, if not all, human tumors. Despite this indisputable therapeutic opportunity, MYC has long been perceived as “undruggable” for its intrinsically disordered nature and fear of catastrophic side effects in normal tissues. Indeed, to date, there is still no MYC inhibitor in the clinic.

We previously designed a dominant negative form of MYC called Omomyc and used its conditional transgenic expression to inhibit MYC function both in vitro and in vivo, demonstrating a potent therapeutic impact in various mouse models of cancer, while causing only mild, well-tolerated and reversible side effects. Importantly, we recently showed that the purified Omomyc mini-protein displays unexpected cell-penetrating properties and can be delivered directly to tissues or by systemic administration to target tumors in different tissues and harboring various oncogenic mutation profiles. These features give the Omomyc mini-protein great potential for clinical development and application in multiple oncological indications. Clinical trials are beginning in 2021.

## P24 - IMMUNOMARK

### Omics integration for precision cancer immunotherapy

**H2020-MSCA-IF-2017; Grant No. 799818**

Immune checkpoint blockade (ICB) has demonstrated durable responses and acceptable toxicity. However, up to ~85% of patients present with innate or acquired resistance to ICB, limiting its clinical utility. Current response biomarker candidates are only weak predictors of ICB response. Our specific scientific goal was to identify definite biomarkers predictive of the response to anti-PD-1, PD-L1, or CTLA4 therapies in patients with metastatic melanoma and advanced Non–Small-Cell Lung Cancer. Our strategy consisted of the multidimensional exploration of putative players in the ICB resistance. One integrated dimension was the stroma, together with the identification of non-invasive biomarkers of response. The most important conclusions were:

1) The most significant mechanisms of response to ICB are driven by a differential activity of specific cells of the immune system, including a novel role for B lymphocyte tumour infiltration.

2) The combination of specific lymphocyte and myeloid cell populations in peripheral blood with specific clinicopathological variables in a logistic regression prediction model increases the ability to predict response with high specificity and sensitivity.

## P25 - InTheMLLrBALL

### Innovative Therapeutic Strategies for Mixed Lineage Leukemia-rearranged B-cell Acute Lymphoblastic Leukemia

**H2020-MSCA-IF-2017; Grant No. 795833**

In B-cell acute lymphoblastic leukaemia (B-ALL), CAR-T cells targeting CD19 have generated unprecedented results, but ~50% of treated patients relapse after 1 year. Many of them experience relapses with loss of CD19. We have developed a CD22/CD19Tan-CAR that incorporates 2 antigen (Ag) binding domains for CD22 and CD19 in tandem as a strategy to offset Ag-loss relapse. Collectively, our data demonstrate that our Tan-CAR warrants a clinical opportunity to test whether simultaneous targeting enhances leukaemia elimination while reducing the risk of relapse.

How to achieve a long-term persistence of CAR-T cells in the host still remains a major challenge, so understanding the interactions between T cells and B-ALL microenvironment is key to further improve the efficiency of current immunotherapies. In an attempt to decipher CD19-CAR T-cell therapy resistance mechanisms in B-ALL, we evaluated the impact of mesenchymal stromal cells (MSC) on CAR-T cells, and we demonstrated that B-ALL MSC do not compromise CD19-CAR T-cell activity. Finally, we characterized immune checkpoints (IC) axes in B-ALL to decide which of them has the major implication in B-ALL to develop future immunotherapies.

## P27 - THAT IS HUNT

### Triggering Haematological Adoptive T-cell Immunotherapy Strategies by HUnting Novel T-cell receptors

**H2020-MSCA-IF-2016; Grant No. 752717**

Nowadays, we can genetically engineer cancer patients' T cells to generate personalized living drugs. Yet, TCR (T cell receptor) gene therapy is currently limited by the paucity of tumor-specific receptors. To tackle this issue, THAT IS HUNT focused on acute myeloid leukaemia (AML) and set up several strategies to identify novel TCRs specific for cancer cells. Exploiting new cutting-edge technologies, THAT IS HUNT characterized the phenotypic features of tumor infiltrating T cells in AML and molecularly studied their immune repertoire by TCR sequencing. Noticeably, a library of 21 TCRs able to recognize 6 different tumor antigens and restricted to 7 HLA alleles was built. Results achieved in the project could be extremely useful to the scientific community for 2 main reasons:

• the detailed profiling of leukaemia-specific T cells will streamline the identification of this peculiar population in patients affected by other tumor entities, hence facilitating the selection of the most efficacious therapy;
• tumor-specific TCRs gathered through the research will be made available to European clinical centres and allow patient-specific T cell therapy for virtually all patients in need.

**P28 - AVITAG**

## Alphaviral Immunotherapy against Glioblastoma

**H2020-MSCA-IF-2015; Grant No. 707093**

Oncolytic virotherapy holds promise of effective therapy against otherwise nonresponsive cancers such as glioblastoma. Our findings have shown that oncolytic alphavirus (based on Semliki Forest virus, SFV) is effective against various mouse glioblastoma models, but its therapeutic potency is hampered by type-I interferon (IFN-I)-mediated antiviral response.
In this project, we have engineered a novel oncolytic SFV which can overcome antiviral IFN-I response in mouse glioma cells resulting in robust tumor-selective viral replication. Importantly, viral replication is associated with induction of immunogenic apoptosis which triggers activation of dendritic cells in vitro. In vivo analysis in mouse glioma model revealed that SFV in combination with anti-PD-1 checkpoint inhibitor promotes immune cell infiltration including increased tumor-reactive CD8+ T cell fraction.
The results of the project show that oncolytic SFV can be used to therapeutically improve the glioma immune microenvironment and pave way for future clinical testing of alphavirus-based immunotherapeutic agents.

**P29 - META-CAN**

## Targeting the metabolism-immune system connections in Cancer

**H2020-MSCA-ITN-2017; Grant No. 766214**

Standard chemotherapy had failed to provide Pancreatic adenocarcinoma (PDAC) patients with a promising treatment option and, although new immunotherapy approaches are efficient in different cancer types, PDAC tumors remain resistant. These tumors are characterized by a dense desmoplastic stroma that impedes oxygen and nutrient diffusion from the blood stream and contributes to a strong hypoxic and acidic tumor microenvironment (TME). A lot of research has been performed on the contribution of acidity to tumor progression and immunotherapy resistance. However, the role of bicarbonate transporters has been mostly neglected. Our research focused on a sodium bicarbonate transporter that based on scRNA-seq data from PDAC patients is the most expressed acid extruder in PDAC and it is selectively expressed in pancreatic ductal cells. In mice, genetical and pharmacological targeting of this transporter in cancer cells increases the pH of the TME leading to an improved T cell-mediated immune response and an increased efficacy of immunotherapy. The study of this transporter could pave the venues towards novel therapeutic strategies to render effective immunotherapeutic regimens in PDAC.

**P30 - pHioniC**

## pH and Ion Transport in Pancreatic Cancer

**H2020-MSCA-ITN-2018; Grant No. 813834**

*pHioniC* brings together highly synergistic expertise to investigate pancreatic ductal adenocarcinoma (PDAC). Our central hypothesis has a strong grounding in pancreas physiology. Secretion of the alkaline pancreatic juice, normally associated with digestion, leads to acidifications of the pancreas stroma resulting in an acid adaptation of pancreatic cells. We propose that this adaptation facilitates PDAC initiation and progression by selecting for aggressive phenotypes in interplay with PDAC driver mutations. *pHioniC* will: 1. develop models to map the pH landscape in the normal and diseased pancreas, 2. characterize the impact of the acidic microenvironment in PDAC development, 3. design approaches to the treatment of PDAC that exploit the unique physiology of the pancreas with nanocarrier and antibody technology. *pHioniC* comprises complementary basic-research, clinical, *in silico* laboratories, and industrial partners with a track record in therapeutic and diagnostic development in oncology. ESR training covers the fields of ion transport, oncology, imaging, bioinformatics and antibody technology, and is complemented by transferable skills and personalised training elements.

**P31 - T-OP**

## Training Network for Optimizing Adoptive T cell Therapy of Cancer

**H2020-MSCA-ITN-2020; Grant No. 955575**

Over the last years, immunotherapy – using a patient's own immune system to fight tumours – has emerged as an important complement to standard treatments. The clinical implementation of immunotherapeutics has established T cells as efficient anti-cancer weapons if targeted by specific drugs. Their therapeutic utilization has recently come to a breakthrough: adoptive T cell therapy (ACT), collecting and transforming the patient's own T cells to treat cancer. The generation of such ACT products is a complex but ill-defined process with limited harmonization across production and clinical studies, even for the same indication. Cytokines are a key element of these products as they are responsible for the growth and differentiation of T-cells. There is however a limited understanding as to which cytokines might lead to the best outcome on any of these steps. T-OP targets a pioneering research question: how do cytokines influence the therapeutic outcome of ACT products? T-OP brings together interdisciplinary and cross-sectorial teams spanning large and small-sized companies as well as experts in different aspects of cell therapy, immunology, protein engineering and bioinformatics.

**P32- TRAIN**

## Tribbles Research and Innovation Network

**H2020-MSCA-ITN-2016; Grant No. 721532**

Dysregulation of common molecular pathways that govern the physiological functioning of adipocytes, immune cells and prostate epithelial cells have been reported in immuno-metabolic disease and several cancers. Our TRAIN ITN project investigated regulators of these pathways, focusing on tribbles (TRIB) proteins, a recently described family of pseudokinases that served as prototypical examples for integrative metabolocentric cancer research. Specifically, TRIBs are envisaged to contribute directly to the development and progression of prostate cancer (PCa), the prognosis of which is substantially worsened in individuals with immuno-metabolic disease. Our multidisciplinary research-training programme set out to uncover cell-specific aspects of TRIB-mediated control

of immuno-metabolism and PCa progression. We contributed to the training of a new generation of scientists with the skills and knowledge to contribute to a step change in our understanding of the mechanisms driving obesity-related tumour aggressiveness and thus pave the way for early diagnosis, prevention and the development of innovative, more 'holistic' cell-therapies.

**P33 - GLIOTRAIN**

**Exploiting GLIOblastoma intractability to address European research TRAINing needs in translational brain tumour research, cancer systems medicine and integrative multi-omics**

**H2020-MSCA-ITN-2017; Grant No. 766069**

Worldwide, there are c.240,000 cases of brain and nervous system tumours per year. Glioblastoma (GBM) is the most frequent and aggressive, with a universally fatal prognosis. 85% of patients die within 2 years despite aggressive treatment. Relatively ineffective treatment costs c.€40,000 per patient, a significant economic burden across Europe. Diverse elements underpin the intractability of GBM, including its infiltrative nature, rapid proliferative rate of malignant cells, treatment resistance, the blood brain barrier impeding access of drugs, activation of multiple signal transduction pathways/ specific gene mutations, and intra/inter-tumoural heterogeneity. New treatment options and effective precision medicine therapies are urgently required. The overall objective of GLIOTRAIN is to identify novel therapeutic strategies for application in GBM, while simultaneously unravelling disease resistance mechanisms. Research activities incorporate applied systems medicine approaches, integrative multi-omics and leverage state of the art technologies implementing the latest clinically relevant models.

**P34 - TRIM-NET**

**Training network in drug discovery targeting TRIM Ubiquitin ligases in disease**

**H2020-MSCA-ITN-2018; Grant No. 813599**

Prostate cancer (PCa) is a major cause of cancer-related death in men worldwide and, despite the progress researchers have recently made, further investigation is needed to improve the survival rates of PCa patients. Our lab previously identified TRIM25 as a negative regulator of p300. p300 is an important co-factor of the androgen receptor (AR), a main driver of prostate cancer and the expression of p300 correlates with a high Gleason score in men diagnosed with PCa. I therefore hypothesized that the E3 ubiquitin ligase TRIM25 could affect the activity of AR and have a role in PCa. Here, I show that knockdown of TRIM25 in LNCaP and PC3 cells resulted in increased cell proliferation. My data further show that TRIM25 significantly reduced the activity of AR when they were co-transfected and this reduction in AR activity was rescued by overexpression of p300. To identify the genes that mediate TRIM25-controlled cell proliferation in PCa, I have performed RNA-seq experiments. By this, I have identified several TRIM25-controlled apoptosis-related genes for further research.

**P35 – CANCERPREV**

**Innovative strategies for cancer prevention with focus on sex hormone signalling and chronic inflammation**

**H2020–MSCA-ITN-2019; Grant No. 859860**

Cancer discordant twin pairs have been analysed for intra-pair differences in epigenetic aging linked to the cancer diagnosis. Epigenetic aging is an aging status prediction based on blood DNA methylation levels. It has been shown that these prediction models show correlation with an individual health and disease status. In this project it is investigated whether and when the diagnosed twins show different epigenetic age than the healthy co-twins. The data for this project has been available from other projects and included many different types of cancer diagnosis. Under all cancer discordant twin pairs, the once diagnosed with breast cancer showed the highest intra-pair differences in epigenetic aging. Therefore, this poster focuses on the results on breast cancer. For expansion of this project an additional number of samples of about 100 breast cancer discordant twin pairs are currently measured for their blood DNA methylation levels, to increase the cohort and enable further analysis.

**P36 - ElectroPros**

**Training research pioneers by utilizing and validating the promise of electroporation for minimal invasive oncological treatments**

**H2020-MSCA-ITN-2018; Grant No. 813192**

Cancer is the second most common cause of death globally. Electroporation-based therapies (EBT) offers a promising treatment alternative for patients, where surgical tumor resection is not possible or where systemic therapies are either too demanding or not sufficient. The ElectroPros project aims at the development of novel EBTs for interventional cancer treatment of primary and metastatic liver tumors. To realize this project, the work is divided into four parts, each concentrating on different aspects of EBT. The first involves the investigation of different probe designs for EBT to achieve optimum tumor ablation. The second concerns with the effect of electroporation on cells via in-vitro studies, thereby creating a strong scientific basis for the application of EBT. The third aims to study the effectiveness of EBT through in-vivo studies and ex-vivo animal experiments. The final aspect focuses on optimizing the treatment planning, by the development of inverse planning algorithms that propose appropriate probe position and pulse settings. The outcome of this project is to create clinical workflow support tools, enabling more clinicians to undertake EBT for cancer treatments.

**P37 - WEFight**

**Holistic health apps for chronic disease management**

**EITHealth Programme**

Europe is experiencing a rise in chronic diseases – the leading cause of mortality and morbidity in the region – resulting in far-reaching implications for our healthcare systems and beyond. Everyday disease management driven by the patient could support people with chronic diseases, including cancer, to stay healthy at home and be less dependent on hospital settings.

In the absence of easy access to a nurse or doctor, patients at home can feel isolated and lonely, often looking online for answers, which can provide unreliable information and lead to greater confusion and anxiety.

EIT Health-supported start-up, Wefight, has developed a solution. Working in collaboration with patient groups, Wefight has created a series of apps named Vik dedicated to specific chronic conditions that work as digital personal health assistants.

Vik supports patients by educating them about their disease, starting from diagnosis, with scientifically backed information, giving them the tools to manage their condition, providing ways for patients to speak to their family and friends, and eventually, giving advice on getting back to work. Vik also helps patients manage their treatment with personalized reminders.

**P38 - BonePainII**

**A European Training Network to Combat Bone Pain**

**H2020-MSCA-ITN-2018; Grant No. 814244**

Bone pain is a common and troublesome symptom of people living with metastatic cancer. When cancers such as prostate cancer, breast cancer or lung cancer metastasize, they often spread to the bone. The patients report the pain as moderate to severe and the analgesic treatment to be inadequate. The current pain treatment includes opioid analgesics, radiation therapy and anti-resorptive drugs; however, there is a need to develop mechanism-based treatments specifically targeting the pathology of cancer-induced bone pain. Cancer-induced bone pain may result from the cancer cells directly activating or sensitizing the peripheral sensory neurons and/or indirectly through changes to the bone-neuron microenvironment. In the MSCA-ITN-2018-ETN BonePainII we develop 3D microfluidic in vitro platforms and high throughput techniques to investigate the interactions in the cancer-bone-neuron microenvironment, and we employ preclinical models and novel imaging technologies to identify key mechanisms underlying cancer-induced bone pain, and to explore new potential therapies for the treatment of cancer-induced bone pain.

# J. E-poster videos

| | |
|---|---|
| **P02** | **BRIDGES**<br>*Bioinformatic approaches to identify and detect both disease and drug-related genomic alterations in breast cancer patients* |
| **P03** | **SCARtool**<br>*Scattered radiation reduction tool to improve computer-aided diagnosis performance in digital breast tomosynthesis* |
| **P04** | **pureCTC**<br>*A lab-on-a-chip device for pure circulating tumor cell isolation from whole blood for cancer therapy* |
| **P05** | **AiPBAND**<br>*An Integrated Platform for Developing Brain Cancer Diagnostic Techniques* |
| **P06** | **UbiCODE**<br>*European Research Training to Decipher The Ub Code: identification of potential biomarkers and drug targets* |
| **P08** | **MAGNAMED**<br>*Novel magnetic nanostructures for medical applications* |
| **P09** | **CanBioSe**<br>*Novel 1D photonic metal oxide nanostructures for early stage cancer detection* |
| **P10** | **miRNA-DisEASY**<br>*microRNA biomarkers in an innovative biophotonic sensor kit for high-specific diagnosis* |
| **P11** | **STOCKHOLM3**<br>*Transforming prostate cancer detection* |
| **P12** | **NANOTAM**<br>*Development and Evaluation of Nanomedicines for Cancer Treatment through Immunomodulation: Targeting Tumor-Associated Macrophages* |
| **P13** | **BRAINHIB**<br>*Integrated drug discovery approach to generate brain-penetrant inhibitors of glioblastoma cell proliferation* |
| **P14** | **NANORNA_PC**<br>*Engineering the protein corona on RNA nanoparticles for improved nucleic acids-based therapies delivery* |
| **P15** | **OMA**<br>*Optimization of Medical Accelerators* |

| | |
|---|---|
| **P16** | **HeatNMof**<br>*Heating triggered drug release from nanometric inorganic-metal organic framework composites* |
| **P18** | **INPACT**<br>*Innovative peptides against cancer and pathogenic bacteria, with advances in science, biopharmaceutical drug development, product market targeting, training , and communication* |
| **P19** | **OXIGENATED**<br>*Hemoglobin based Protein Nanocarriers for Tumour Oxygenation and a more effective Photodynamic Therapy* |
| **P20** | **FourCmodelling**<br>*Conflict, Competition, Cooperation and Complexity: Using Evolutionary Game Theory to model realistic populations* |
| **P21** | **iCARE-2**<br>*Mechanobiology of nanoparticle-cell interactions to develop therapies against cancer* |
| **P22** | **THERADNET**<br>*International NETwork for training and innovations in THErapeutic RADiation* |
| **P23** | **PEPTOMYC**<br>*Reimagining cancer treatment through MYC inhibition* |
| **P24** | **IMMUNOMARK**<br>*Omics integration for precision cancer immunotherapy* |
| **P25** | **InTheMLLrBALL**<br>*Innovative Therapeutic Strategies for Mixed Lineage Leukemia-rearranged B-cell Acute Lymphoblastic Leukemia* |
| **P27** | **THAT IS HUNT**<br>*Triggering Haematological Adoptive T-cell Immunotherapy Strategies by Hunting Novel T-cell receptors* |
| **P28** | **AVITAG**<br>*Alphaviral Immunotherapy against Glioblastoma* |
| **P29** | **META-CAN**<br>*Targeting the metabolism-immune system connections in Cancer* |
| **P30** | **pHioniC**<br>*pH and Ion Transport in Pancreatic Cancer* |
| **P31** | **T-OP**<br>*Training Network for Optimizing Adoptive T cell Therapy of Cancer* |

| | |
|---|---|
| **P32** | **TRAIN**<br>*Tribbles Research and Innovation Network* |
| **P33** | **GLIOTRAIN**<br>*Exploiting GLIOblastoma intractability to address European research TRAINing needs in translational brain tumour research, cancer systems medicine and integrative multi-omics* |
| **P34** | **TRIM-NET**<br>*Training network in drug discovery targeting TRIM Ubiquitin ligases in disease* |
| **P35** | **CANCERPREV**<br>*Innovative strategies for cancer prevention with focus on sex hormone signaling and chronic inflammation* |
| **P36** | **ElectroPros**<br>*Training research pioneers by utilizing and validating the promise of electroporation for minimal invasive oncological treatments* |
| **P37** | **WEFight**<br>*Holistic health apps for chronic disease management* |
| **P38** | **BonePainII**<br>*A European Training Network to Combat Bone Pain* |

The Marie Skłodowska-Curie actions (MSCA) projects are managed by the European Research Executive Agency (REA)

**Follow REA on social media**:

https://twitter.com/REA_research

https://bit.ly/2SShio3